AN EXAMINATION OF THE RELATIONSHIPS AMONG POSITIVE AND NEGATIVE MOOD STATES, COGNITION, AND RISK ESTIMATION

By

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In general, people believe they are less likely than others to experience negative events and more likely than others to experience positive life events. This phenomenon is known as the optimistic bias (Weinstein, 1980). Though researchers have studied many of the moderators of the optimistic bias, researchers have given little attention to the role of mood and mood's effect on cognition when people make risk estimates.

In the present research, I used three studies to examine whether positive and negative mood states affected risk estimates. In addition, I examined the relationship between mood, event-related thoughts and risk estimates. The studies yielded little effect of mood on risk estimates. However, the three studies did reveal that event specific thoughts are related to risk estimates. In particular, it seems that (a) the extent to which people think about things that put them at risk is positively related to personal risk estimates, (b) the extent to which people think about things that they do to avoid a particular event is negatively related to personal risk estimates, (c) the extent to which people think about things that put others at risk is positively related to target risk estimates, and (d) the extent to which people think about things that others do to avoid an event is negatively related to target risk estimates. Based on the results of three studies, it is concluded that mood has relatively minor effects on risk estimates, and that the making of risk estimates is a thoughtful cognitive process.

INTRODUCTION

Cognitive biases and illusions (Taylor & Brown, 1988) help people sustain the belief that they are better than others in a variety of ways. For example, people often believe they are in control of random events when such events are actually uncontrollable (Langer, 1975). They believe they are a central actor in events of which they are only a part (Greenwald, 1980), and they believe good outcomes are more likely and bad outcomes are less likely for themselves than for others (Weinstein, 1980). These misperceptions and biases may contribute to happiness (Taylor & Brown, 1988). However, some biases, if gone unchecked, could lead people to engage in behaviors that might place them at risk for physical or mental harm. For example, unrealistically optimistic beliefs may lead people to fail to take precautionary behavior.

The optimistic bias is the belief that one is more likely than others to experience positive events and less likely than others to experience negative events (Weinstein, 1980, 1983). Research reveals that people are optimistically biased for a variety of negative events including unwanted pregnancy, negative consequences of drinking alcohol, victimization, lung cancer, heart disease, auto accidents, AIDS and car injury (Long & Sangster, 1993; Perloff & Fetzer, 1986; Schwarzer, 1994; Taylor, 1989; Tennen & Affleck, 1987; Weinstein, 1980, 1983, 1987). People are also optimistically biased for a variety of positive events including rewards of group membership, managerial success, and having fewer health problems than the average other (Brinthaupt, Moreland & Levine, 1991; Larwood & Whittaker, 1977; Weinstein, 1980, 1987).

Though a few studies examine the topic, there is surprisingly little research examining the effect of mood on judgments of the likelihood of future events. The existing studies find that positive moods are related to increased optimism and greater optimistic biases while negative moods are related to decreased optimism and smaller optimistic biases (Abele & Hermer, 1996; Forgas & Moylan, 1987; Salovey & Birnbaum, 1989, Taylor & Shepperd, 1998). However, research examining the effect of mood on the optimistic bias is incomplete. Specifically, there are discrepancies in the effect of mood on the optimistic bias (Abele & Hermer, 1996, Salovey & Birnbaum, 1989). In addition, researchers still do not understand why mood affects risk estimates. There are also questions regarding the thought processes that affect the optimistic bias. Researchers have only begun to explore the thoughts of people who are making risk estimates. People could be thinking about any number of things, such as factors that put them at risk, factors that put others at risk, or not thinking at all. Whether thoughts influence the optimistic bias and the effect mood may have on such thoughts is largely unexplored. This dissertation examines the effect of mood and cognition on risk estimates.

Causes of the Optimistic Bias

Researchers hypothesize several reasons why people display optimistic biases in their risk estimates. Some researchers argue that optimistically biased predictions stem from to a desire to feel in control of the outcome of an upcoming event (McKenna, 1993). Other researchers propose that people maintain optimistically biased predictions because expecting positive outcomes is gratifying. That is, it feels good and reduces anxiety to believe that good things will happen and bad things will not happen (Kirscht, Haefner, Kegeles & Rosenstock, 1966). Researchers also believe that the social comparison processes used for self-enhancement and self-protection could lead to the selection of particular comparison targets that might produce optimistically biased expectations (Weinstein & Klein, 1996). It is also possible that optimistically biased expectations reflect little more than a desire to regard oneself as better than average (Alicke et al. 1995).

Moderators of the Optimistic Bias

Other research examines moderators of the optimistic bias. Many factors specific to the situation may affect peoples' risk estimates. First, perceptions of control may lead people to be more optimistically biased (Harris, 1996; Hoorens, 1994; Perloff, 1983; van der Velde, Hooykaas & van der Pligt, 1992; Weinstein, 1980, 1982, 1987). In general, people are more optimistically biased for events over which they perceive having control than events over which they perceive having no control (Harris, 1996; Weinstein, 1980). Second, the importance of an event or the seriousness/severity of the event's consequences affect the optimistic bias (Taylor & Shepperd, 1998; Weinstein, 1980). Often, as the severity of the outcome increases, so too does the optimistic bias (Heine & Lehman, 1995; But see Taylor & Shepperd, 1998). Third, people are often less optimistically biased when they anticipate a challenge to their optimistic expectations (Shepperd, Oulette & Fernandez, 1996; Taylor & Shepperd, 1998). That is, if people believe they will receive feedback that might disconfirm their optimistically biased risk estimates, they often bring their own risk estimates in line with average other estimates.

There are also several characteristics of people that may lead them to display more or less of an optimistic bias. Past experience with a particular event may decrease risk estimates, at least temporarily (Burger & Palmer, 1992; Dolinski, Gromski, & Zawisza, 1987). For example, California residents who lived through an earthquake believed they were more at risk regarding their likelihood of being injured in 'another natural disaster like an earthquake' (Burger & Palmer, 1992; Helweg-Larsen, 1999). In addition, people with a history of sexually transmitted disease are less optimistically biased about their chance of infection with HIV (van der Velde et al. 1992).

Other research finds that information about a particular incident may influence risk estimates. Often, mass media campaigns use information about a disease and the people who contract it to influence peoples' judgments of risk in an attempt to increase precautionary behavior (Stapel & Velthuijsen, 1996). Using this information, people may raise or lower personal or target risk estimates and therefore, change their optimistic bias.

Various arousal states can also influence the optimistic bias. In particular, people who are anxious about an upcoming event tend to be less optimistically biased than people who are not anxious. For example, students preparing for an exam, an anxiety-provoking event, are less optimistically biased about their upcoming performance than students who have already taken the exam (Dewberry & Richardson, 1990). In addition, affective states, some fleeting and specific to the situation, others more enduring, lead to fluctuations in risk estimates. For example, depressed moods lead people to make more pessimistic forecasts (Abramson, Metalsky & Alloy, 1989; Beck, 1976).

Mood and Judgment

Recently, Forgas (1995) proposed the affect infusion model to explain the effects of mood on judgment. The Affect Infusion Model (AIM) is a dual process model that assumes that affect may influence judgment through one of two processing strategies.

The two processing strategies lead to different effects of mood. Specifically, the AIM suggests that positive moods evoke a more heuristic based processing strategy that leads people to make judgments fairly quickly with little thought or effort. Conversely, negative moods are to evoke more substantive processing by close attention to detail and available information. This difference in processing strategy could produce marked differences in risk estimates reflected in an optimistic bias. Moreover, the AIM may provide an explanation of mood effects on risk estimates and ultimately a process explanation for mood effects on judgment.

The Cognitive Aspect of the Optimistic Bias

The effect of cognition on the optimistic bias has received little attention in optimistic bias research. Although many people have attempted to manipulate what people think about when making risk estimates (e.g., Weinstein, 1980; 1983; Klein & Weinstein, 1995), few studies examine what people are thinking about when they make their risk estimates (Shepperd et al. 1996, Sanna, 1999). Are risk estimates influenced by the extent to which people are thinking about things that they do that put them at risk for a certain event or things that they do to avoid a particular event? Might the same findings hold true for risk estimates for the average other? That is, when people think about things that others do that put them at risk do they make higher target risk estimates? Conversely, if people think about things that others do to avoid a particular event, might they make lower target risk estimates?

Overview

The present research had three goals: (1) To test a theoretical explanation for the effect of positive and negative mood states on the optimistic bias, (2) to examine the processes that might underlie the differential impact of positive and negative mood on personal and target estimates, and (3) to examine what people think about when they make risk estimates and the effect such thoughts have on risk estimation.

REVIEW OF LITERATURE

People hold a variety of biased beliefs and perceptions to maintain the view that they are better than others (Taylor & Brown, 1988). For example, people believe they have more control over random events than is actually the case (Langer, 1975). In addition, people claim responsibility for positive events that happen to them while externalizing responsibility for negative events (Ross & Sicoly, 1979). People also display an egocentric bias, believing they are the cause of the occurrences around them (Greenwald, 1980). In general, these biases produce positive effects such as positive mood (MacFarland & Ross, 1982), greater productivity (Baumeister, 1989), higher self-efficacy (Bandura, 1986), and better well being (Taylor & Brown, 1988; but see Colvin & Block, 1994). However, some biases, if gone unchecked, could lead people to engage in behaviors that might prove damaging to physical or mental health.

One bias that could affect physical and mental health is the optimistic bias. The optimistic bias is the belief that one is more likely than others to experience positive events and less likely than others to experience negative events (Perloff & Fetzer, 1986; Weinstein, 1980, 1983). In the first study to examine the optimistic bias, Weinstein (1980) found that college students believed they were more likely than their peers to experience positive events such as winning the lottery, living a long life, having good health, or travelling extensively, and less likely than their peers to experience negative events such as violent crimes, sexual abuse, or dental problems (Weinstein, 1980). Over time, research has revealed that people are optimistically biased for a variety of events including unwanted pregnancy, negative consequences of drinking alcohol, victimization, lung cancer, heart disease, auto accidents, AIDS, car injury, tooth decay, skin cancer, divorce, burglary, unemployment, having gifted children, marrying someone wealthy, rewards of group membership, managerial success, and having fewer health problems than the average other to name a few (Brinthaupt, Moreland & Levine, 1991; Drake, 1984; Larwood & Whittaker, 1977; Long & Sangster, 1993; Perloff & Fetzer, 1986; Schwarzer, 1994; Taylor, 1989; Tennen & Affleck, 1987; Weinstein, 1980, 1983, 1987). Importantly, the optimistic bias is not limited to college students but also appears among children (Whalen, Henker, O'Neil & Hollingshead, 1994) and in community samples (Weinstein, 1986).

Explanations for the Optimistic Bias

Researchers have hypothesized several reasons why people display an optimistic bias. Some researchers argue that optimistically biased predictions are the result of a desire to feel in control of an upcoming event's outcome (Perloff, 1987; McKenna, 1993). Langer (1975) proposed a need for control leads people to have an illusion of control for events over which they have no control. The illusion of control might lead people to believe they have the ability to attain a desired outcome when in fact the outcome is in the hands of fate. For example, gamblers often believe they have more control over the throw of the dice if a certain ritual is performed prior to the toss (Gilovich, 1991). Such illusions of control could lead people to provide lower risk estimates than circumstances would warrant.

Other theorists propose that people maintain optimistic biases because such expectations are gratifying. That is, it feels good to believe that positive outcomes will be obtained and negative outcomes will be avoided. Research reveals that people who believe their preferred outcome will come true feel better (Cantril, 1938; Sherman, 1980). Other research finds that people who are optimistically biased are happier and more productive (Taylor & Brown, 1988). Furthermore, believing that negative outcomes will not occur may reduce anxiety (Kirscht, Haefner, Kegeles, & Rosenstock, 1966). For example, acknowledging the possibility of getting into a car accident every time one drives would be anxiety provoking. People may choose to believe that their risk is less than that of the average drivers' risk to avoid such anxiety.

Researchers also propose that social comparison processes used for self-enhancement and self-protection may lead to the selection of particular social comparison targets that might decrease risk estimates (Weinstein & Klein, 1996). Though social comparison theory originally asserted that people tend to compare themselves with similar others (Festinger, 1954), subsequent research reveals that people also compare themselves downwardly to targets who are worse off (Suls & Wills, 1991; Wills, 1981). Furthermore, if a favorable comparison target is unavailable, people may go so far as to invent imaginary downward comparison targets (Taylor, Wood & Lichtman, 1983). Past research of the optimistic bias finds that people may compare themselves to prototypical victim stereotypes (Perloff & Fetzer, 1986; Weinstein, 1980). Presumably such downward comparisons make people feel better about their own risk (Wills, 1981) and help maintain self-esteem (Tesser, 1988). When viewed through the lens of social comparison processes, stereotypic victims serve as downward social comparison targets that may lead people to view negative events as less likely for the self.

It is possible that optimistically biased expectations reflect little more than a desire to be better than average (Alicke et al., 1995). People often maintain unrealistically positive images of themselves relative to others (Alicke et al., 1995). For example, people believe they are better than average on items related to depression (Tabachnik, Crocker, & Alloy, 1983), trait ratings (Alicke, 1985; Dunning, Meyerowitz, & Holzberg, 1989) and behavior ratings (Allison, Messick, & Goethals, 1989). Klein and colleagues (Klein, 1996; Klein & Kunda, 1993) find that people like to maintain a relative advantage in their perceptions of the likelihood of future events and will adjust their risk estimates to reflect new information. In a typical study people are exposed to false frequency norms regarding the number of times peers engaged in heath threatening behaviors. When these norms suggest that peers engage in fewer heath threatening behaviors than the self, people adjust their own health threatening behavior estimates to maintain a relative advantage (Klein & Kunda, 1993).

As evident, a variety of explanations for the optimistic bias reflect several cognitive and motivational processes. Motivational explanations emphasize the role of self-esteem protection (Suls & Wills, 1991, Tesser, 1988; Wills, 1981), and self-enhancement (Taylor, Wood & Lichtman, 1983) while cognitive explanations emphasize errors in perception or information processing (Nisbett & Ross, 1980). Often, the line between cognitive and motivational explanations is difficult to draw (Tetlock & Levi, 1982). However, it is likely that the optimistic bias is multi-determined.

Moderators of the Optimistic Bias

Other research examines moderators of the optimistic bias. Moderators of the optimistic bias may be separated into two categories; some reflect characteristics of the situation while others reflect characteristics of the individual.

Situational Factors.

Many situation or event factors may lead people to express more or less of an optimistic bias in their risk estimates. One such factor is perceived control (Harris, 1996; Hoorens, 1994; Perloff, 1983; van der Velde, Hooykaas & van der Pligt, 1992; Weinstein, 1980, 1982, 1987). In general, people are more optimistically biased for events over which they perceive having control than events over which they perceive having no control (Harris, 1992; Weinstein, 1980). For example, McKenna (1993) found that when asked about their likelihood of experiencing a car accident, people displayed a greater optimistic bias when they imagine being the driver of the car rather than when they imagined being the passenger. Importantly, drivers of automobiles perceive they have more control over accidents than passengers (McKenna, 1993). In addition, people are more optimistically biased for high-control than low-control car accident scenarios when imagining being the driver but not when imagining being the passenger (McKenna, 1993). Similar patterns are found for health risk estimates. People who perceive that they have control over contracting the HIV virus are more optimistically biased than people who believe contraction of the virus is beyond their control (van der Velde, Hooykaas, & van der Pligt, 1992). In addition, increased perceptions of control over developing full-blown-AIDS leads people to be more optimistically biased (van der Velde, Hooykaas, & van der Pligt, 1992). Finally, after reviewing the optimistic bias/control literature Harris (1996) concluded that there was sufficient evidence to suggest an association between perceived controllability and the optimistic bias, particularly for negative events.

A second moderator of the optimistic bias is the importance of an event or the seriousness/severity of an event's consequences (Taylor & Shepperd, 1998; Weinstein, 1980). Heine and Lehman (1995) found that optimism was correlated with an outcome's perceived severity. As the severity of the outcome increases, so too does optimism.

However, there are times when people may be less optimistically biased for events with severe consequences than events with consequences that are not severe. Specifically Taylor and Shepperd (1998) found that people were less optimistically biased about an event with severe consequences, but only when they believed they would receive feedback that could challenge their optimistic expectations. This "challenge to optimistic expectations" constitutes another situational moderator of the optimistic bias. Other research confirms that people opt for more modest expressions of optimism when such optimistic predictions are likely to be challenged (Gilovich, Kerr, & Medvec, 1992; Shepperd et al., 1996). For example, Gilovich et al. (1992) had students estimate their scores on midterm exams and anagram tasks and found that predictions of success became more modest as feedback regarding the accuracy of the estimates drew near. Shepperd et al. (1996) had students estimate their score on an exam four times, once prior to taking the exam and three times afterwards. Similar to the results of Gilovich et al. (1992), as the time of performance feedback drew near, students' predictions of success dropped dramatically until, seconds before receiving feedback, they became pessimistic in their expectations.

Personal Factors

People may bring certain characteristics to situations that lead them to be more or less optimistically biased. Specifically, past experience with a particular event may decrease optimistic biases (Burger & Palmer, 1992; Dolinski, Gromski, & Zawisza, 1987). Dolinski et al. (1987) found that Polish students who were exposed to radiation due to a nuclear meltdown rated themselves as more likely than the average student to suffer health problems as a result of the exposure. Similarly, California residents who lived through an earthquake were less optimistically biased regarding their likelihood of being injured in another natural disaster such as an earthquake (Burger & Palmer, 1992). However, this decrease in the optimistic bias was fairly short-lived. Within three months, participants returned to their original optimistically biased perceptions (Burger & Palmer, 1992; but see Helweg-Larsen, 1999). Other research reveals that people who have experience with high-risk sexual behavior are less optimistically biased regarding their chances of contracting HIV (van der Velde et al., 1992). Moreover, people with a history of sexually transmitted disease are less optimistically biased about their chance of infection with HIV (van der Velde et al., 1992). Clearly, past experience affects personal risk estimates. Indeed, after a thorough review of the literature, Weinstein (1989) concluded that personal experience generally leads people to see risk events as more frequent and view themselves at more risk for future victimization. This may be because experience leads people to think about risk more often and realize their limited control (Weinstein, 1989).

Information about a particular risk and the way such information is presented can also influence risk estimates. Mass media campaigns geared toward boosting precautionary behavior have the specific purpose of influencing peoples' judgments of risk (Stapel & Velthuijsen, 1996) and such campaigns are often successful (Heath & Petraitis, 1987; but see Dunwoody & Neuwirth, 1991). Though many factors inherent to the information presented in such campaigns have yet to be studied, a few factors have received attention. One such factor is how information is presented. Research reveals that people exposed to more vivid information about car accidents and car accident risk are less optimistic about their chance of being involved in a car accident than those exposed to pallid or no information about car accidents (Stapel & Vilthuijsen, 1996). Importantly, vivid information increased personal risk estimates rather than decreasing estimates of the population risk.

Research also has examined how the similarity of a victim might influence risk estimates. Here research finds that people who see themselves similar to a victim rate their own risk higher than people who seem themselves as dissimilar to a victim (Stapel & Vilthuijsen, 1996). For example, people who see themselves as similar to a victim of hospital-acquired infection are more likely to rate themselves at higher risk for hospital-acquired infection than their peers who saw the victim as dissimilar.

Various feelings, some fleeting and specific to the situation, others more enduring, lead to fluctuations in the optimistic bias. In particular, depressed moods lead people to make more pessimistic forecasts (Abramson et al., 1989; Beck, 1976). For example, students who are mildly depressed, as measured by the Beck depression inventory, make more pessimistic forecasts for themselves than an average other when estimating future GPA (Alloy & Ahrens, 1987). Importantly, depressed people tend to be less optimistic for their own expectations rather than having universally negative expectations for themselves and others (Taylor & Armor, 1998). Indeed, a substantive body of evidence suggests that relative optimism is reduced in depressed people (Pietromonaco & Markus, 1985; Pyszczynski, Holt, & Greenberg, 1987). It is interesting to note, however, that when expectations are compared with actual outcomes, depressed people are as optimistic as non-depressed people. That is, the expectations of people with depressive symptoms exceed performance outcomes (Dunning & Story, 1991). Using actual performance versus expectation of performance as a measurement technique, depressed people seem as prone to the optimistic bias as do non-depressed people.

More transient affective states can cause fluctuations in the optimistic bias as well. People experiencing anxiety about an upcoming event are often less optimistically biased than people who are not anxious. For example, students preparing for an exam, who presumably are anxious, are less optimistically biased than students who have already taken the exam (Dewberry & Richardson, 1990). In a more extensive investigation of anxiety's effect on risk estimates, Shepperd et al. (1996) had students estimate their performance on an exam on four separate occasions, once before the exam and then three times prior to receiving feedback. As feedback became imminent, students became less optimistic about their exam performance. Mediation analyses suggested that the drop in estimates was at least partially due to mounting anxiety over forthcoming feedback (Shepperd et al., 1996; See also Taylor & Shepperd, 1998).

A few studies have examined the impact of more general positive and negative moods on the optimistic bias. In general, these studies find that positive moods are associated with greater optimistic bias, while negative moods are associated with less optimistic bias (Abele & Hermer, 1996; Forgas & Moylan, 1987; Salovey & Birnbaum, 1989). Related research finds that probability estimates for negative events are lower when people are in a positive mood and higher when people are in a negative mood (Johnson & Tversky, 1983). A similar study conducted by Wright and Bower, (1992) examined both negative and positive events. Once again, for negative events, positive moods lowered peoples' probability estimates while negative moods increased them. Furthermore, for positive events, positive moods increased peoples' probability estimates while negative moods decreased them (Wright & Bower, 1992).

However, research examining the effect of mood states on the optimistic bias is incomplete. Specifically, although there is evidence that mood affects risk estimates, the reason for the effect remains unknown. Although researchers propose that positive and negative affective states elicit different processing strategies (Forgas, 1995; Schwarz, 1990), researchers have not examined how different processing strategies might affect risk estimates. In addition, much of the mood and optimistic bias research examines personal and target estimates together, as a composite measure. Interestingly, different mood states might prompt people to consider different information relevant to risk judgments. Therefore, different mood states may differentially impact personal and target risk estimates.

Affect: A Brief Overview

In the past, many researchers regarded mood as an irrelevant aspect of cognition and behavior (Miller & Ross, 1975). However, as cognitive theories warmed and the role of motivation in cognition became evident, research turned it's eye toward the role of mood in information processing (Blaney, 1986, Bower, 1991; Forgas, 1995; Mackie & Worth, 1989; Schwarz, 1990). Research reveals a complicated and diverse effect of mood on many cognitive processes (Blaney, 1986; Bower, 1991; Clark & Isen, 1982; Forgas, 1995; Isen, 1984; Schwarz, 1990, Zajonc, 1980).

Early research examining the effect of mood on cognition revealed that mood could strongly affect person perception. For example, people who are fearful are more likely to perceive other people as fearful as well (Feshbach & Singer, 1957). Other research confirms that mood plays an important role in general person perception (Forgas & Bower, 1987) but can also effect more specific person perception such as partner selection (Forgas, 1991).

More recent research has examined phenomena such as mood effects on information encoding and retrieval (Blaney, 1986; Bower, 1981, 1991; Forgas, 1991; Forgas, 1995). Research reveals that people are more likely to recall information that is congruent with their current mood than information that is mood incongruent (Bower, 1981; Isen, Shalker, Clark, & Karp, 1978; but see Isen, 1984). For example, happy people often show impaired memory for negatively valenced personal material (Brown & Taylor, 1986). This may be due to mood states activating mood-congruent self-schemata (Brown & Taylor, 1986).

Mood also affects the reception of persuasive communications. Specifically, positive affect during message exposure decreases systematic processing of the message (Bohner, Crow, Erb & Schwarz, 1992). Therefore, happy people tend to rely more on source cues and less on systematic assessment of message quality in persuasion situations (Mackie & Worth, 1989, 1991). However, more recent research (Wegener, Petty & Klein, 1994) finds that mood effects vary depending on whether the message is elaborated or not. Other research examines the effect of mood on social comparison processes (Weary, Marsh & McCormick, 1994), the expression of negative stereotypes toward groups (Esses & Zanna, 1989; Bodenhausen, 1993; Haddock, Zanna & Esses, 1994) perceptions of risk (Pietromonaco & Rook, 1987), and choices for risky and non-risky situations (Weary & Williams, 1990).

Mood also can affect judgments (Forgas, 1995). For example, people induced to experience a happy mood judge event outcomes more positively than people induced to experience a sad mood (Izard, 1964). In addition, positive moods can influence people's liking for a variety of targets including other people (Forgas & Bower, 1987), household appliances (Isen, Shalker, Clark & Karp, 1978), and schools (Clark, Milberg & Ross, 1983). Mood also affects judgments of things as varied as the humor elicited by cartoons (Strack, Martin & Stepper, 1988), quality of task performance (Martin, Ward, Achee & Wyer, 1993), and degree of interpersonal attraction (White, Fishbein, & Rutstein, 1981).

Mood can have a particularly strong effect on judgments of and about the self (Schwarz, 1990). For example, positive moods affect judgments of life satisfaction (Schwarz & Clore, 1983), happiness (Schwarz & Clore, 1988) and optimism about the future (Forgas & Moylan, 1987). Mood can also affect judgments of self-competence. Correlational work by Kanfer and Zeiss (1983) suggests that depressed people have lower self-efficacy expectancies than non-depressed people for a variety of events. In addition, mood appears to influence self-efficacy expectations regarding behavior in domains such as romance, athletic performance (Kavanagh & Bower, 1985) and interpersonal helping (Salovey & Rosenhan, 1989). Mood can even affect health appraisals and symptom reporting (Salovey & Birnbaum, 1989). For example, in healthy people positive moods, compared with negative moods, result in higher self-appraisal of health status and lower numbers of symptoms reported (Croyle & Uretzky, 1987). More recent work reveals that, among the ill, those who are happy report fewer symptoms and less pain associated with their symptoms than do those who are not happy (Salovey & Birnbaum, 1989). Clearly, mood can have a strong effect on cognition and decision-making.

Why Does Mood Affect Cognition: Theories and Research

There now is wide acceptance that mood affects choice of social situation, evaluation of acquaintances, the self-concept and self-efficacy, attitudes, persuasion and judgment. Researchers propose several theories to account for the varied mood effects but no one theory accounts for all mood effects (Bower, 1981, 1991; Mackie & Worth, 1989; Schwarz, 1990). Recently, however, Forgas (1995) proposed a new model, the Affect Infusion Model (AIM), to integrate competing theories. What follows is a brief description of different theoretical orientations followed by the integrative AIM.

Affective Priming Models

Most models that attempt to explain the relationship between mood and cognition are memory based. These models assert that cognitive categories are stored in memory along with the affect that accompanies these categories (Bower, 1981, 1983, 1991; Clark & Isen, 1982; Isen, 1984;). Bower (1981) and colleagues (e. g., Forgas & Bower, 1987) propose an affect priming model to explain the effect of mood on cognition. According to the affect priming model, affect influences social judgment by facilitating access to related cognitive categories. Emotions have a specific unit in memory that is linked with events from one's life during which that emotion occurred. The experience of an emotion spreads activation throughout the brain to the memories to which the emotion is connected (Bower, 1981). That is, affect primes or activates concepts in memory that are associated with a certain affective state (Bower, 1991).

The basic principle of affect priming leads to several tenets (Forgas, 1991). First, the model predicts that the recall of information should be better when an individual is in a mood similar to the mood during encoding (mood state-dependent memory). Second, the model predicts that people are motivated to attend selectively to information that is congruent with the mood that prevails at the time. Third, information should be interpreted in ways that are consistent with the prevailing mood because of the greater availability of mood-consistent concepts that are used in associating incoming information. Finally, people should learn information that is consistent with current mood better than information that is inconsistent. The reason mood may affect cognition, then, is that good moods lead to more positive thoughts and bad moods lead to more negative thoughts (Watson & Pennebaker, 1989).

Since Bower's initial theorizing about affect priming models, several studies have confirmed and supported the basic tenets. For example, people often prefer situations they believe will maintain their existing mood. That is, people in a positive mood are likely to choose impersonal situations that maintain their positive mood and people in a negative mood are likely to choose impersonal situations that maintain their negative mood (Bower, 1991). Specifically, happy people choose to view happy scenes (people laughing or celebrating) longer than sad people, whereas sad people choose to view sad scenes (failures or funerals) longer than happy people (Bower, 1983).

A similar mood-congruent effect appears in preferences for social situations. People who are in a positive mood seek out and want to know about others in a positive mood. Likewise, people in a negative mood seek out and want to know about others in a negative mood. For example, depressed people seek out more information about sad people than about happy people (Gibbons, 1986). Reflecting a similar mood congruency effect is evidence offered by Swann and Pelham (1988) who asked college roommates who had been randomly assigned to their dorm room whether they would like to live with their roommate again. Students desire to continue living with the roommate depended on whether the roommate had a positive or negative evaluation of them. The important factor was not that the roommate evaluated them positively, but rather that the evaluation by the roommate matched that of the participant. That is, people who had a negative evaluation of themselves wanted to stay with others who had a negative evaluation of them. The same findings held for people with positive evaluations of themselves (Swann & Pelham, 1988).

Perhaps the most influential role affect priming plays is in social judgments. Given that judgment is often a constructive process (Forgas, 1995), there is ample opportunity for mood to influence judgment at various stages of processing (ex. attention, encoding, retrieval, and schema availability). Supporting the affect priming hypothesis is research by Tversky and Kahneman (1973) revealing that judgments are often based on what is most easily brought to mind. If Bower's (1981) network theory is correct and particular moods bring to mind mood congruent thoughts, mood congruent judgments should follow (Mayer & Bremer, 1985). In fact, mood congruent judgments are often found. For example, judges rate their schools (Clark, Milberg & Ross, 1983), other people (Forgas & Bower, 1987) their partner (Forgas, 1991) and other objects more positively when in a positive mood, yet rate these same targets more negatively in a negative mood (Bower, 1991).

Importantly, not all studies examining the affect priming account are supportive of the model. Indeed, several studies do not find the predicted memory effect for mood (Blaney, 1986; Bower & Mayer, 1985; Morris, 1989). Attempts to account for these findings often involve post hoc explanations that reduce the falsifiability of the theory. In addition, the mood effects that are found are often more robust and enduring for positive moods than for negative moods. As such, there are several modifications and additions to the affect priming account (Forgas, 1991; 1995). However, these modifications and additions reduce the parsimony inherent in the original model. As a result, other theories were proposed to account for mood's effect on cognition.

Mood as Information

Schwarz (1990; Schwarz & Clore, 1983) proposed that affect might directly influence judgments. Specifically, Schwarz (1990) proposed that "rather than computing a judgment on the basis of recalled features of the target, people may ... ask themselves: 'How do I feel about it?' [and] in doing so, they may mistake feelings due to a pre-existing state as a reaction to the target" (Schwarz, 1990, p. 529). Therefore, in its early formulation, mood as information theory hypothesized that mood was used as a heuristic for judgments and positive moods lead to positive judgments while negative moods lead to negative judgments.

An intuitively appealing aspect of the mood as information account is the ability to test its central tenet. Specifically, if people are reminded that their mood may be influenced by an outside source, they should attribute their mood to that source and mood should have no effect on judgment. In fact, this is often the observed outcome. In one study Schwarz and Clore (1983) called people on the telephone and asked them a number of questions including life satisfaction items. People called on rainy days were less happy and less satisfied with their lives than people called on sunny days. However, when people were called on rainy days and reminded of the weather, an object to which they could attribute their negative mood, they rated their happiness and life satisfaction the same as those called on sunny days.

More recently, Schwarz and colleagues (Schwarz & Bless, 1991) have fleshed out specific details of the mood as information theory. In revision, the mood as information theory posits that when in a positive mood, people are inclined to view the world as a safe place, believing that the environment is benign (Schwarz, 1990). As a result, people feel there is no need to scrutinize the situation or the surroundings in an elaborate manner. They see no reason to engage in detailed, systematic processing of information because they perceive no threat to the self. Positive moods are suggested, therefore, to lead to a processing strategy that relies heavily on heuristics, with little attention to detail. Consistent with this reasoning, happy people are more likely to use heuristics in problem solving situations than are sad people (Schwarz & Bless, 1991).

Conversely, negative moods are thought to signal danger in the environment or the threat of negative outcomes, and that action is needed to avoid problems. However, prior to taking action, people must carefully assess the current situation, assess causal links and explore possible mechanisms for change to occur (Schwarz & Bless, 1991). Thus, negative moods are hypothesized to elicit more careful, effortful processing of information. Critical analysis of the data, attention to detail, and a high degree of logical consistency characterize effortful processing. However, this effortful, analytic processing may come at the cost of creative problem solving skills (Schwarz, 1990).

Considerable research supports the revised mood as information theory (Clore & Parrot, 1991; Forgas, 1995; Schwarz & Clore, 1983, 1988; Schwarz, Strack, Komer & Wagner, 1987). The mood as information effect appears for judgments of life satisfaction (Schwarz & Clore, 1983), happiness (Schwarz & Clore, 1988), understanding (Clore & Parrot, 1987) and persuasion (Bless et al. 1990).

As evident, affect priming and mood as information models account for many mood effects. However neither fully accounts for all data. For example, while mood as information models predict mood effects only at the encoding and retrieval stages, a number of studies show mood effects at the encoding, learning and attention stages. Mood effects at the encoding learning and attention stages are accounted for by affect priming models. The inability to account for all data and the null results of some studies are frequent. As a result, Forgas (1995) conceived of another, more integrative model.

AIM (Affect Infusion Model)

Recently, Forgas (1995) proposed the affect infusion model to explain the effects of mood on judgment. The Affect Infusion Model (AIM) is a dual process model that assumes that affect influences judgment through one of two processing strategies. The two processing strategies lead to the different effects of mood.

First, the AIM makes two assumptions about social judgments. The first assumption is that the effect of mood on judgment largely depends on what kind of processing strategy is used. The second assumption is that people attempt to minimize the amount of effort put into information processing and will adopt the simplest and least effortful processing strategy (Forgas, 1995). Forgas proposes that affect is likely to have the greatest effect in conditions that require more constructive and generative rather than re-constructive processing strategies (Forgas, 1995). The second supposition, that people try to minimize their effort during cognitive processing, has its roots in social cognition (Fiske & Neuberg, 1990). According to this view, people have a relatively small amount of time and cognitive capacity to make decisions. To maximize efficiency, people are forced to adopt strategies that render more cognitive resources available when possible.

According to Forgas (1995), the degree of affect infusion varies along a processing continuum. Specifically, when making judgments, people may rely on one of four alternative processing strategies: (a) direct access of a stored judgment, (b) motivated processing in service of mood repair or a preexisting goal, (c) simplified or heuristic processing, and (d) systematic or substantive processing (Forgas & Fiedler, 1996). The first two processing strategies allow minimal amount of affect infusion in cognition while the last two strategies allow affect to play a more influential role in judgment.

When people use the direct access strategy, they retrieve an already formed and stored judgment. This strategy is likely to occur when there are no strong affective, cognitive, motivational or situational factors causing the individual to engage in more effortful processing, the target is well known or familiar and the person making the judgment is not personally involved (Forgas, 1995). Given these situational constraints, there is no need to engage in constructive processing to form a judgment and the judgment is likely to be resistant to any affective influences (Snyder, 1984).

The second processing strategy, the motivated processing strategy, is used when strong and specific motivational pressures push for the achievement of particular judgmental outcomes (Forgas, 1995). When people choose to arrive at a particular conclusion, their information search is guided toward specific information that will allow them to arrive at the desired conclusion. This motivation is quite distinct from a motivation to be accurate (Tetlock & Kim, 1987). Rather, the motivated strategy assumes that the actor has a specific, preferred outcome that guides information search, retrieval and ultimately judgment. Many goals are served by motivation including self-enhancement, self-verification, and mood repair or mood maintenance.

Simplified and heuristic processing is a high affect infusion strategy that is adopted when no prior evaluation is made, when there is no motivated goal, and when people wish to minimize the amount of effort they put into cognitive processing (Forgas, 1995). Using a heuristic processing strategy, people will take short cuts during their decision making process and may reduce their evaluation of the available information. The heuristic processing strategy likely accounts for many of the findings in the mood as information framework.

The final processing strategy, substantive processing, requires the judge to select new information and integrate this information into existing knowledge structures to arrive at an accurate judgment (Forgas, 1995). This strategy is the most cognitively demanding. It requires the judge to select, learn and interpret new information and to relate the information into existing knowledge structures. Substantive processing should occur when the judgment is particularly complex and when the judge has no specific motivation to be accurate. For example, when people are asked to estimate the likelihood of a certain event, they would likely engage in substantive processing (Forgas, 1995). In these instances, mood would play a significant role in judgment in its selective influence on the kind of information used in computing a judgment (Bower, 1991; Forgas, 1995).

With these four processing strategies, the AIM accounts for most of the findings in the mood and judgment literature. However, given the recency of its conception, strong tests of the model's central tenets await. Nonetheless, the AIM is a parsimonious and thorough theory that resolves inconsistencies and fills gaps in the mood literature.

The Effect of Mood on Risk Estimates

A few studies examine the effect of mood on judgment of likelihood of future events. Early research examining perceptions of event likelihood found that when people are happy they often underestimate the likelihood that negative events will occur. Conversely, when people are sad they overestimate the likelihood of a negative event occurring (Johnson & Tversky, 1983). Other studies find the reciprocal occurrence. That is, people in a positive mood give higher likelihood estimates of positive events than people in neutral or negative mood states (Erber, 1991; Forgas & Moylan, 1987).

Since the work of Johnson and Tversky (1983) a few studies examined the effect of mood on judgments of future outcomes using a quasi-experimental design. For example, Forgas and Moylan (1987) asked people coming out of movies that presumably induced happy, sad, or neutral moods, to make forecasts about the future. People exiting happy movies were more optimistic about the future than people exiting sad movies.

Two studies manipulated mood experimentally and examined its effect on the optimistic bias. In the first of three experiments, Salovey and Birnbaum (1989) recruited college students from the waiting room of a campus student health clinic. After being induced into a positive, neutral or negative mood, participants appraised the variety and intensity of their physical symptoms and were questioned about their health behavior efficacy. Study 1 revealed that participants induced to feel sad reported more symptoms and more discomfort with those symptoms than neutral mood participants and participants induced to feel happy. In addition, sad participants were less likely than neutral or happy mood participants to believe that they were capable of performing behaviors that would lead to their recovery.

The results of study 1 led Salovey and Birnbaum to speculate that negative appraisals generalize to judgments of future events. In study 2, sick participants induced into a positive, neutral or negative mood rated their likelihood and the average Yale student's likelihood of experiencing fourteen positive and negative life events. Consistent with the optimistic bias, participants believed they were more likely than their peers to experience positive events and less likely than their peers to experience negative events. However, the effect of mood on probability judgment was quite weak and not statistically significant for any group. Salovey and Birnbaum reasoned that, because they used unhealthy participants, mood influences on probability judgments were attenuated by the impact of participant's health status on these judgments (Salovey & Birnbaum, 1989). To test this idea, the authors conducted a third study.

In study 3, healthy undergraduate students participated in the same mood induction procedure and the same probability estimation procedure used in study 2. The hypothesis was that participants induced into a happy mood would rate positive events as most likely followed by participants in a neutral mood, followed by participants induced into a sad mood. Conversely, it was hypothesized that participants induced into a sad mood would rate negative items as most likely followed by participants in a neutral mood followed by participants induced into a happy mood. The mood manipulation was effective, but the hypothesized effect was found for only negative health items. Happy participants always rated their risk of negative events as less than the risk of their peers. No such effect was found in sad participants. Interestingly, mood had no effect on judgments of positive events.

Abele and Hermer (1993) replicated and extended the findings of Salovey and Birnbaum (1989) by collecting estimates for a wider range of negative events (not only severe events) and by specifying the parameters of the event (e.g. 'probability of an accident injury within the following year') rather than leaving them in a general form (e.g. 'sometime in your lifetime'). Participants rated their personal and the target's likelihood of experiencing negative events on separate scales ranging from zero to 100 percent. In line with research conducted by Salovey and Birnbaum, participants in a negative mood were more likely to rate themselves at risk (as measured in comparison to the average other) than participants in a neutral or positive mood. In contrast to Salovey and Birnbaum, however, participants in a positive mood were more likely to rated themselves at less risk than participants in a neutral mood.

Questions About Past Research

Though past research reveals that mood moderates the optimistic bias, many questions remain. First, there are relatively few experimental studies examining the phenomenon. Most studies are correlational rather than experimental. Though correlational work is important, experimental control is necessary to assert causality.

Second, the findings of the two studies that experimentally manipulate mood are somewhat incomplete and inconsistent. The second study conducted by Salovey and Birnbaum yielded no effects and the third study suffers from a small sample. In addition, both Salovey and Birnbaum (1989) and Abele and Hermer (1993) examine their data using difference scores to measure optimism. If participants rate their own risk as less than the risk of the target then participants are labeled optimistic. If there is no difference between personal and target risk estimates then participants are said to be realistic. If participants rate their own risk as more than the risk of the target then they are labeled pessimistic. Using this method of data analysis, it is difficult to determine whether positive and negative mood differentially affect personal and target risk estimates. It may be that positive mood affects average other risk estimates while negative mood affects personal risk estimates.

Recently, Helweg-Larsen and Shepperd (1999) re-analyzed the data from Abele and Hermer (1993) and Salovey and Birnbuam (1989) for personal and target risk estimates separately (Shepperd & Helweg-Larsen, 1999). Analysis revealed consistent findings for participants in a positive mood. Positive mood lead to a greater optimistic bias. However, participants in a sad mood respond very differently across the two studies. Participants in a sad mood in the Salovey and Birnbaum (1989) study were more optimistic in their personal risk estimates than target risk estimates. However, Abele & Hermer (1993) obtained the opposite results. Their participants were more pessimistic in their personal risk estimates than target risk estimates (Helweg-Larsen & Shepperd, 1999).

In addition, critical examination of these data reveals that people in a positive mood tend to inflate target risk estimates relative to people in a neutral mood. However, people in a negative mood inflate personal risk estimates relative to people in a neutral mood. These findings are consistent across studies yet neither study addresses why mood might have different effects on personal and target risk estimates.

Also, none of the research examining mood and the optimistic bias posits a relationship between mood, cognition and the optimistic bias. Given the affective priming hypothesis we can assume that different information is available for making risk estimates depending on whether one is in a positive or negative mood. If this is the case, mood would have an indirect effect on the risk estimates, an important factor that much research examining the optimistic bias has failed to consider. The present research examines how event related thoughts affect the optimistic bias and whether such thoughts are influenced by mood.

The Present Research

The present studies extend past research examining the effect of mood on optimism. First, I approach the question of whether mood affects optimism by examining how mood affects personal and target risk estimates separately. Previous research examining mood effects on risk estimates has created composite scores from these measures, not allowing analysis of changes in personal and target risk estimates independently. It may be that positive and negative moods affect personal and target risk estimates differently. Given past theorizing on mood, I propose that positive and negative mood will have different effects based on the processing style that accompanies each mood. Specifically, positive moods should invoke a more heuristic processing style that would lead people to be more optimistic, while negative moods should invoke a more substantive processing style that leads people to be less optimistic as they weigh their own risks and others' risks more evenly.

In addition, the effect of cognition on the optimistic bias has received very little research attention. Only a few studies examine the thoughts that are present when people make their risk estimates (Shepperd et al. 1996, Sanna, 1999). Risk estimates may be influenced by the extent to which people think about things that they do that put them at risk. Also, it may be that when people think about things that others do that put them at risk they make higher target risk estimates? Conversely, if people think about things that they and others do to avoid particular events, they may make lower personal and target risk estimates.

This dissertation represents three studies exploring the relationship between mood, cognition and the optimistic bias. The purpose of the present studies was threefold: (1) To test a theoretical explanation for the effect of positive and negative mood states on the optimistic bias, (2) to examine the processes that might underlie the differential impact of positive and negative mood on self and other estimates, and (3) to examine the effects of different thoughts on the optimistic bias.

STUDY 1

Overview and Hypotheses

Study 1 examined how moods may differentially affect personal and target risk estimates. In addition, I examined the relationship between event related thoughts and peoples' risk estimates. Participants placed into a positive or negative mood made risk estimates for themselves and the average person for four common negative events. In addition, participants reported the extent to which they were thinking about risk factors and avoidance factors while making risk estimates. I tested four hypotheses:

Hypothesis 1: Consistent with prior research I predicted that participants in the negative mood condition would be less optimistically biased than would participants in the positive mood condition.

Hypothesis 2: I predicted that participants in the positive mood condition would rate the targets' risk to be greater than would participants in the negative mood condition. Given that positive moods invoke heuristic processing, I believe that people set their own risk estimate and then use that estimate as an anchor and estimate that the target is more at risk than they are.

Hypothesis 3: I predicted that participants in the negative mood condition would rate their own risk to be greater than would participants in the positive mood condition. Given past theorizing, I believe negative moods evoke more ruminative thought and such rumination causes people to consider more factors that place them at risk.

Hypothesis 4: I predicted that event related thoughts would be related to risk estimates such that a greater number of thoughts regarding risk for the target event would be positively related to risk estimates and a greater number of thoughts regarding target event avoidance would be negatively related to risk estimates.

Method

Overview and Design

The design was a 2 (Target of estimate: Self vs. Other) X 2 (Mood: Positive vs. Negative) mixed model with target of estimate serving as a within-subjects factor and mood serving as a between-subjects factor.

Participants met an experimenter who explained that the study involved memory and risk perception. The experimenter then induced a positive or negative mood using the autobiographical recollection method. Following the mood manipulation all participants rated the likelihood that four events would happen to them and the average student (their age and sex). Following the procedure participants were debriefed and given a gift (i.e. a small bag of candy) to induce a positive mood.

Participants

Forty-one introductory psychology students (N = 41) participated in sessions consisting of one to four participants. Their participation earned them partial credit for a course requirement. All conditions were randomly determined prior to participants' arrival.

Procedure

On arriving at the laboratory, participants learned that they would complete two short studies. The first study was an examination of how well people could remember a past event in detail and the second study was part of a nationwide effort to collect information regarding risk perceptions for various life events.

Following completion of an informed consent (Appendix A), participants learned that the first study examined how well people could visualize and remember a past event. The experimenter then guided participants through a mood manipulation procedure (Batson et al., 1988; see also Manucia, Baumann & Cialdini, 1984; Salovey & Birnbaum, 1989; Singer & Salovey, 1988).

All participants recollected experiences from their past. Participants in the positive mood condition recalled and ruminated about "an event from your past that makes you feel very happy every time you think about it". Participants in the negative mood condition recalled and ruminated about "an event in your past that makes you feel very sad every time you think about it". Participants then dwelled on the activity or event "by picturing the surroundings, seeing the people and objects, hearing the sounds in the environment, generally experiencing the event actually happening to you all over again". Participants were told that they "should feel the same emotions and react as you did when the event happened". Following the visualization process, the experimenter required participants to write 10 specific details of the activity and emotions that the event or activity evoked and reasons why the event or activity evoked such feelings or emotions.

This mood induction, commonly referred to as the autobiographical recollection method (Goodwin & Williams, 1982) or self-generated imagery (Salovey & Rodin, 1985;

Singer & Salovey, 1988), is an effective means of manipulating mood. Brewer, Doughtie, and Lubin (1980) found the procedure to be more effective than Velten's (1968) mood inducing self-statements that are commonly used to manipulate mood.

Following completion of the mood induction, participants completed a personal reactions inventory. The personal reactions inventory contained a six-item measure of current affect, happy, joyful, glad, sad, depressed, and upset, as well as a three-item measure of state anxiety, anxious, nervous, and tense (Appendix B). Participants used 7-point scales to indicate the extent to which they were feeling each emotion at that moment in time. The scale was anchored with endpoints "1 = not at all" and "7 = very much."

A separate administration of these items was given to a group of 52 undergraduates. Principal components analysis with varimax rotation and keeping only factors with eigenvalues greater than one revealed that the measure had a three factor structure accounting for 81% of the variance. The eigenvalue for the first factor was 4.17, for the second factor the eigenvalue was 1.76, and for the third factor the eigenvalue was 1.36. The rotated factor pattern is presented in Table 1.

As evident, negative affect items loaded highly on one factor, positive affect items loaded highly on a second factor and the anxiety items loaded highly on the third factor.

Table 1.

Rotated Factor Pattern of the Nine Affect Questions

	Factor 1	Factor 2	Factor 3
Depressed	**.857**	-.206	.226
Sad	**.906**	-.215	.089
Upset	**.850**	-.168	.353
Glad	-.104	**.915**	-.076
Happy	-.357	**.852**	-.146
Joyful	-.165	**.863**	-.056
Nervous	.216	-.258	**.833**
Tense	.229	-.206	**.767**
Anxious	.118	.136	**.834**

Note: N = 52

After completing the personal reactions inventory, the experimenter informed participants that they would begin the second study. Prior to beginning the study all participants completed a second informed consent (Appendix C). Participants learned that the second study involved gathering information regarding what college students believed to be their risk and the average student's (their age and sex) risk for various life events. Participants then completed a risk estimation packet examining risk perception of four events: having an accident injury within the next year, having a hangover within the next three months, failing a class while at the University of Florida, and catching a cold within the next three months. Risk estimates assessed participant's beliefs that they and the average student their age and sex were at risk for the event (Appendix D). On each page of the questionnaire participants were presented with four items asking about risk for each event. Participants then indicated how much time they spent thinking about their risk estimates. Finally, four items assessed the extent to which participants were thinking about their own and the average person's risk and risk avoidance factors. After completing all 9 items for a particular event, participants went on to the next event until they had completed the entire packet.

Participants made risk estimates using two different scales. First, participants rated separately the likelihood that they and the average student their age and sex would experience the event using a scale ranging from "1 = not at all likely" to "9 = very likely." Second, participants rated separately the probability that they and the average student their age and sex would experience the event using a scale ranging from 0 to 100 % where "0 = no probability" and "100 = complete probability."

After making the four risk estimates for a particular event, participants answered five questions regarding their estimates for that event. First, participants estimated how much time they spent thinking about the risk estimates they just made. Responses were made on a scale ranging from "1 = not very much" to "9 = a lot". Next, participants estimated the extent to which they were thinking about: (1) things that they do to avoid the event, (2) things that other people do to avoid the event, (3) things that they do that put them at risk for the event, and (4) things that other people do that put them at risk for the event, during risk estimation. Responses were made on scales ranging from "1 = not at all" to "9 = very much". Following completion of the final questionnaire, participants were thoroughly debriefed and given a gift (e.g. a small bag of candy) to induce a positive mood. All participants understood the necessity of the mood induction and none objected to the procedure.

Results

Manipulation Checks

Three items assessed participants' positive mood (alpha = .90) and three items assessed participants' negative mood (alpha = .94). Subtracting the total negative mood score from the total positive mood score created a general mood index (positive numbers indicating a positive mood, negative numbers indicating a negative mood). A t-test of the composite scores revealed that participants in the positive mood condition ($M = 11.44$) were in a better mood overall than participants in the negative mood condition ($M = -0.56$), $t(39) = 5.22$, $p < .001$. In addition, I conducted two t-tests to determine whether participants' moods differed significantly from zero (another indication of positive and negative mood). Analysis revealed that general mood scores of participants in the positive mood condition were greater that zero, t (22) = 10.74, $p < .0001$. However, mood scores of participants in the negative mood condition did not significantly differ from zero, t (17) = -.03, $p > .95$. It appears that participants in the positive mood condition were in a positive mood while participants in the negative mood condition were in a neutral mood.

Another analysis was conducted to determine whether the mood manipulation created any differences in anxiety between participants in the positive mood condition and participants in the negative mood condition. Scores on the three anxiety items were added to create an anxiety index (alpha = .61). A t-test revealed no difference in anxiety scores between the two groups, t (39) = .88, $p > .35$. Therefore, it appears that the manipulation of mood was effective independent of any manipulation of anxiety. Finally, positive mood correlated negatively with negative mood ($r = -.55$; $n = 41$; $p < .0001$) and positively with anxiety ($r = .34$; $n = 41$; $p < .04$). Negative mood and anxiety were uncorrelated ($r = -.21$; $n = 41$; $p > .19$).

Risk Estimates

Likelihood and probability estimates for each event were correlated to determine whether these indices measured risk estimates in a similar or different manner. If the two estimates were strongly correlated, they could be collapsed. The correlations for the four events were all greater than $r = .80$. As a result, I standardized the likelihood and probability risk estimates and combined them to from a single probability scale. All analyses reported below reflect standardized probability estimates.

The first analysis examined whether participants were optimistically biased in their risk estimates in general. I created difference scores by subtracting personal risk estimates from target risk estimates, such that positive scores reflected an optimistic bias, negative scores reflected a pessimistic bias, and scores of zero indicated realism. In total, four difference scores were created. I conducted four t-tests to determine whether participants' personal risk estimates were significantly less than participants' target risk estimates. Each test yielded a significant effect indicating that participants were optimistically biased (See Table 2).

Hypothesis 1 predicted that participants in the negative mood condition would be less optimistically biased than would participants in the positive mood condition. Because I made the same prediction for each event, I collapsed across the four difference scores to form a general difference score. I then conducted a t-test to determine whether participants in the negative mood condition were less optimistically biased than participants in the positive mood condition, across events. A t-test revealed no difference in overall optimistic bias between participants in the positive mood condition (M = 24.27) and participants in the negative mood condition (M = 20.67), t (39) = .74, $p > .45$.

To probe for differences in optimistic bias scores for each individual event that might be due to mood, I conducted four independent sample t-tests. Analysis revealed no differences in optimistic bias scores between participants in the positive mood condition and participants in the negative mood condition, all t's < 1.4 and all p's > .18. Means are presented in Table 3. As evident, participants in the positive mood condition were, in general, more optimistically biased than were participants in the negative mood condition

Table 2.

Relative Risk Estimates

Event	Personal	Target	diff	t	p
Accident Injury	47.83	69.67	21.84	6.16	.0001
Hangover	51.39	83.90	32.51	5.68	.0001
Fail a Class	23.94	54.94	31.00	9.20	.0001
Catch a Cold	60.86	66.74	5.88	2.48	.02

Note: Higher scores reflect a greater optimistic bias.

in three of four cases. However, none of the differences was significant. Thus, Hypothesis 1 was not supported.

Hypothesis 2 predicted that participants in the positive mood condition would make higher target risk estimates than would participants in the negative mood condition. I collapsed target risk estimate across the four events to examine overall mood difference in target risk estimate. Analysis revealed no difference in target risk estimate due to mood between positive mood condition participants ($\underline{M} = 70.41$) and negative mood condition participants ($\underline{M} = 66.76$), $\underline{t}\ (39) = -.03$, $\underline{p} > .97$. I then probed differences in target risk estimate for each event. Means are presented in Table 4 and are consistent with the hypotheses in three of four cases. However, analysis revealed no significant differences based on mood for any of the four events, all $\underline{t}$'s < 1.40 and all $\underline{p}$'s $> .18$. As evident, positive mood did not lead to higher target risk estimates than negative mood.

Hypothesis 3 predicted that personal risk estimates made by participants in the negative mood condition would be greater than personal risk estimates made by participants in the positive mood condition. I combined the personal risk estimates from the four events to form a single indicator of personal risk and conducted a t-test to test for differences due to mood. Analysis revealed no difference in overall personal risk estimate due to mood between participants in the positive mood condition ($\underline{M} = 45.94$) and participants in the negative mood condition ($\underline{M} = 46.09$), $\underline{t}\ (39) = .66$, $\underline{p} < .51$. To probe for differences in personal risk estimate for each event I conducted a series of independent sample t-tests. Means are presented in Table 5 and support the hypothesis in two of the four cases. Analyses revealed no differences in personal risk estimates for any of the four events, all $\underline{t}$'s < 1.18 and all $\underline{p}$'s $> .24$.

Table 3.

Relative Risk Estimates as a Function of Mood

Event	Positive Mood	Negative Mood	diff	t	p
Accident Injury	26.11	16.36	9.75	1.38	.18
Hangover	32.05	33.09	-1.04	-.09	.93
Fail a Class	32.02	29.69	2.33	.34	.74
Catch a Cold	7.69	3.55	4.14	.86	.39

Note: Higher scores reflect a greater optimistic bias.

Table 4.

Target Risk Estimates of Participants in Positive and Negative Mood States

Event	Positive Mood	Negative Mood	diff	t	p
Accident Injury	72.48	66.07	6.41	.91	.37
Hangover	84.55	83.06	1.49	.23	.82
Fail a Class	59.34	49.31	10.03	1.34	.19
Catch a Cold	65.26	68.62	-3.36	-.45	.65

Note: Means reflect target risk estimates made by participants in positive and negative moods.

Table 5.

Personal Risk Estimates of Participants in Positive and Negative Mood States

Event	Positive Mood	Negative Mood	diff	t	p
Accident Injury	46.36	49.71	-3.35	-.56	.58
Hangover	52.51	49.97	2.54	.21	.83
Fail a Class	27.32	19.62	7.70	1.18	.24
Catch a Cold	57.57	65.07	-7.50	-1.04	.31

Note: Means reflect target risk estimates made by participants in positive and negative moods.

It is possible that the mood manipulation did not invoke a positive or negative mood as intended. To determine whether reported mood, rather than mood condition, affected risk estimates I conducted three internal analyses. I used reported general mood score as a predictor of the three overall estimates (collapsing measurements and events): (1) overall optimistic bias (2) overall personal risk estimate (3) overall target risk estimate. Each of these yielded no effects. Specifically, reported general mood was not related to overall optimistic bias score, $\underline{F}$ (1, 40) = .62, $\underline{p} > .43$ ($\underline{B} = .23$, $\underline{p} > .12$), overall personal risk estimate, $\underline{F}$ (1, 40) = .10, $\underline{p} > .75$ ($\underline{B} = -.06$, $\underline{p} > .71$), or overall target risk estimate, $\underline{F}$ (1, 40) = .18, $\underline{p} > .67$ ($\underline{B} = .16$, $\underline{p} > .30$). Therefore, internal analyses revealed that, in addition to mood condition having little effect on risk estimates, reported mood also had no effect on risk estimates.

In sum, mood had no appreciable effect on risk estimates. This finding is somewhat surprising given that past research finds that people in a negative mood are less optimistically biased and less optimistic in general than people in a positive mood.

Ancillary Findings

Several items were included after each set of risk estimates to assess what participants were thinking when making personal and target risk estimates for each event. Specifically, four items assessed the extent to which participants were thinking of: (1) things that they do that put them at risk for the event, (2) things that others do to put them at risk for the event, (3) things that they do to avoid the event and (4) things that others do to avoid the event.

I conducted a series of t-tests for each event to examine differences in event related thoughts that were due to the mood induction. Analysis across all items yielded a single significant effect of mood. Participants in the negative mood condition ($M = 7.9$) were thinking about things that others do that put them at risk for having a hangover to a greater extent than were participants in the positive mood condition ($M = 6.3$), $t(39) = 2.21$, $p < .02$. This finding is counter to what I would expect given that negative moods are believed to lead to more negative, self-focused thought (Forgas, 1996; Pyszczynsky, Holt & Greenberg, 1987). No other effects approached significance, all t's < 1.4 and p's > .17.

Thoughts as Risk Estimate Predictors

It is difficult to know exactly what participants were thinking about when making their risk estimates. However, the responses to the thought questions represent the thoughts participants reported when making the risk estimates. I hypothesized that thinking of things that would put one or a target at risk would be positively related to risk estimates while thinking about things that would lead oneself or a target to avoid a negative event would be negatively related to risk estimates. I conducted a series of regression analyses to determine whether event related thoughts were related to risk estimates. Specifically, I simultaneously entered each of the four thought questions as predictors for each risk estimate for each event

Although the global analyses did not yield consistent findings across events, I conducted exploratory analyses of those events that did yield effects to probe whether these effects were in line with predictions. Importantly, two events that yielded significant effects revealed a fairly consistent pattern of results. In general, the extent to which participants reported thinking about things that they do that put them at risk for an event was positively correlated with personal risk estimates. However, the extent to which participants reported thinking about things that they do to avoid an event was negatively correlated with personal risk estimates. Similar results were obtained for target risk estimates. That is, the extent to which participants reported thinking about the things that others do that put them at risk for an event was positively correlated with target risk estimates. In addition, the extent to which participants reported thinking about things that others do to avoid an event was negatively correlated with target risk estimates. Results are presented in Table 6. Those thoughts that are at least marginally significantly related to risk estimate are bolded. As evident, analysis yielded significant results for a portion of two of the four events.

Table 6.

Results of Regression Analyses Using Thought Items as Predictors of Risk Estimates

Event	Thought	Person Risk B	p	Target Risk B	p
Accident Injury	Personal Risk	**.46**	**.08**	-.02	.93
	Personal Avoid	-.14	.78	**-.95**	**.02**
	Target Risk	-.01	.96	**.40**	**.07**
	Target Avoid	-.24	.60	**.98**	**.03**
Hangover	Personal Risk	**.51**	**.02**	.10	.68
	Personal Avoid	**-.65**	**.01**	-.11	.64
	Target Risk	-.24	.25	.35	.12
	Target Avoid	.16	.41	.12	.57
Fail a Class	Personal Risk	.37	.10	.23	.32
	Personal Avoid	-.30	.24	-.04	.89
	Target Risk	-.28	.21	-.10	.69
	Target Avoid	.02	.93	-.21	.36
Catch a Cold	Personal Risk	-.24	.54	-.12	.75
	Personal Avoid	-.04	.88	-.26	.34
	Target Risk	.73	.10	.64	.13
	Target Avoid	-.21	.52	.03	.92

Note: Significant findings in bold.

Discussion

The autobiographical recollection task was a somewhat effective mood inductor. Participants in the positive mood condition reported being in a better mood than did participants in the negative mood condition. However, the negative mood manipulation did not put people in a mood discrepant from a base zero. The fact that mood had no effect on risk estimates is surprising. Past correlation and experimental studies find that negative moods tend to depress optimistic biases while positive moods tend to exacerbate optimistic biases.

Given that mood had little effect on risk estimates, it was difficult to determine whether or not mood had any effect on thoughts related to the events. Also, because there were no differences in risk estimates based on mood it is difficult to assert that there were any differences in the way people processed information. As a result, I could not test the Affect Infusion Model.

I was able to examine how self-reported target event related thoughts were related to risk estimates. Importantly, only a handful of the results yielded findings in line with predictions. Therefore, any conclusions drawn from analysis are tentative. However, the events that did yield significant findings revealed that participants who reported focusing on things that put them at risk for an event also tended to make higher personal risk estimates. Participants who reported focusing on things that they do to avoid a particular event, also tended to make lower personal risk estimates. Similarly, when people reported thinking about things that others do that put them at risk for an event they tended to make higher target risk estimates. However, when people reported thinking about things that others do to avoid particular events, they tended to make lower target risk estimates. Although the data are correlational and based on self-reports, one interpretation is that readily available thoughts guide risk estimations. Many theorists have asserted that judgment is a constructive process that depends on what information is available (Kahneman & Tversky, 1977).

I conducted a second study to examine further the interesting link between event related thoughts and risk estimates as well as the puzzling finding that mood had a limited effect on risk estimates

STUDY 2

Overview and Hypotheses

A second study examined whether mood moderates the optimistic bias and how event related thoughts are related to the optimistic bias. Two changes took place for Study 2. First, the format of the risk estimation task was changed. In Study 1 the questions assessing personal and target risk estimates were placed next to one another. It was easy for participants to use the first estimate they made as a reference and comparison. Perhaps the desire to be seen as 'better than average' (Alicke et al., 1995) overpowers the effect of mood when this measurement technique is used. However, if people are forced to make all risk estimates for themselves first, and then all risk estimates for the average other, they may have less opportunity to compare the risk estimates. Mood, therefore, may have a stronger influence when participants are forced to think about their own risk estimates and then risk estimates for the average person. This second study was conducted to determine whether the manner of risk estimate presentation would influence the effect of mood on risk estimates.

Second, the regression analyses using event related thoughts as predictors of personal and target risk estimates yielded several interesting findings. Therefore, the same four questions regarding event related thoughts were included to replicate and confirm the predictive value of these questions. In addition, I administered a thought-listing task following the risk estimation task to examine the effect of mood on specific target event related thoughts.

The hypotheses for Study 2 were similar to the hypotheses of Study 1:

Hypothesis 1: I predicted that participants in the positive mood condition would be more optimistically biased than would participants in the negative mood condition.

Hypothesis 2: I predicted that participants in the positive mood condition would rate the target to be at more risk than would participants in the negative mood condition.

Hypothesis 3: I predicted that participants in the negative mood condition would rate their own risk as greater than would participants in the positive mood condition.

Hypothesis 4: I predicted that event related thoughts would be related to risk estimates such that a greater number of thoughts regarding risk for the target event would be positively correlated with risk estimates, and a greater number of thoughts regarding target event avoidance would be negatively related to risk estimates.

Method

Overview and Design

The design was a 2 (Target of estimate: Self vs. Other) X 2 (Mood: Positive vs. Negative) mixed model with target serving as a within subjects factor and mood serving as a between subjects factor.

Participants met an experimenter who explained that the study involved risk perception. The experimenter then induced a positive or negative mood using the autobiographical recollection method. Following the mood manipulation all participants rated the likelihood that four different events would happen to them and the average student (their age and sex). In addition, following the risk estimation, participants engaged in a thought-listing task. Finally, participants were debriefed and given a gift (e.g. a small bag of candy) to place all participants in a positive mood.

Participants

Twenty-four introductory psychology students ($N = 24$) participated in sessions consisting of one to three participants. Participation earned partial credit for a course requirement. All conditions were randomly determined prior to participants' arrival.

Procedure

The procedure for Study 2 mimicked the procedures of Study 1. Participants completed the ostensible memory study (mood induction) to induce either a positive or a negative mood state. After completing the personal reactions inventory assessing positive and negative mood and anxiety, participants completed a risk estimation packet. Participants made personal and target risk estimates first using a likelihood scale ranging from one to nine and then a probability scale ranging from zero to 100. However, the risk estimation packet was different from that of the previous study. On the first page of the packet participants made personal risk estimates for each of the four events using the one to nine likelihood scales. Then, on the second page of the packet, participants made target risk estimates for each of the four events using the one to nine likelihood scales. On the third page of the packet participants made personal risk estimates for each of the four events using the probability scale ranging from zero to 100 and on the fourth page of the packet participants made target risk estimates for each of the four events using the probability scale ranging from zero to 100.

After completing all four risk estimation packet pages, participants answered four questions regarding their thoughts during the risk estimation for all events. First, participants estimated “To what extent were you thinking about things that you do to avoid those situations”. Second, participants estimated “To what extent were you thinking about the things that other people do to avoid those situations”. Third, participants estimated “To what extent were you thinking about the things that you do that put you at risk for those situations”. Finally, participants estimated “To what extent were you thinking about the things that other people do that put them at risk for those situations”. Responses for all four items were made on scales that ranged from “1 = not at all” to “9 = very much”. After completing risk estimates for each event and answering each of the four questions, participants engaged in a thought-listing task during which they wrote down "exactly what they were thinking about when they made their estimates”. Following completion of the final questionnaire, participants were thoroughly debriefed and given a gift (e.g. a small bag of candy) to induce a positive mood.

Results

Manipulation Checks

The same six items were used to assess participants' positive and negative mood. Two mood indices, one positive and one negative, were created by summing scores on the three positive (alpha = .91) and the three negative (alpha = .93) items. Subtracting negative mood scores from positive mood scores created an index of general mood. A t-test of the composite scores revealed that participants in the positive mood condition were in a better mood overall ($\underline{M} = 9.00$) than participants in the negative mood condition ($\underline{M} = -4.23$), $\underline{t}\,(21) = 3.88$, $\underline{p} < .001$. In addition, I conducted two one sample t-tests to determine whether participant’s moods were different from zero. Analysis revealed that general mood scores of participants in the positive mood condition were greater that zero, $t\ (9) = 3.41$, $p < .008$. Importantly, mood scores of participants in the negative mood condition were only marginally significantly different from zero, $t\ (12) = -1.93$, $p < .08$. It appears that participants in the positive mood condition were again in a positive mood and participants in the negative mood condition were in a somewhat negative mood.

An analysis was conducted to examine differences in anxiety between participants in the two mood conditions. The same three anxiety items (alpha = .64) were used to create a composite score. A t-test revealed no difference in anxiety scores between participants in the two groups, $t\ (22) = .07$, $p > .90$. Finally, anxiety, positive mood, and negative mood were correlated. Analysis revealed that positive mood was negatively correlated with negative mood ($r = -.81$). In addition, anxiety was uncorrelated with positive mood ($r = .01$) and negative mood ($r = .08$).

Primary Dependent Measures

I examined the correlation between the likelihood and probability estimates for each event to determine whether these indices could be combined. As with Study 1, all four correlations were all greater than $r = .80$. Therefore, I standardized the risk estimates and combined them to form a single scale.

The first analysis examined whether participants were optimistically biased in their risk estimates in general. I created difference scores by subtracting personal risk estimates from target risk estimates, such that positive scores reflected an optimistic bias, negative scores reflected a pessimistic bias, and scores of zero indicated realism. In total, four difference scores were created. I conducted four t-tests to determine whether participants' self-risk estimates were significantly less than participants' target risk estimates. Each test yielded a significant effect indicating that participants were optimistically biased (See Table 7).

Hypothesis 1 predicted that participants in the negative mood condition would be less optimistically biased than would participants in the positive mood condition. Because I made the same prediction for each event, I collapsed across the four difference scores to form a general difference score. I then conducted a t-test to determine whether participants in the negative mood were less optimistically biased than participants in a positive mood, across events. Contrary to predictions, analysis revealed that participants in the negative mood condition ($M = 40.23$) were more optimistically biased than participants in the positive mood condition ($M = 26.06$), $t\ (22) = -2.09$, $p < .05$.

To further probe this difference in overall optimistic bias score, I conducted four t-tests. Results are presented in Table 8. Though participants in the negative mood condition were more optimistically biased than participants in the positive mood condition for each event, only one of the four tests yielded significant differences. Participants in the negative mood condition ($M = 28.79$) were more optimistically biased in their probability estimates of catching a cold than participants in the positive mood condition ($M = 9.97$), $t\ (22) = 2.15$, $p < .05$. These results are puzzling and counter to predictions.

Table 7.

Relative Risk Estimates

Event	Personal	Target	diff	t	p
Accident Injury	44.56	71.55	26.99	5.79	.0001
Hangover	47.37	88.00	40.63	5.95	.0001
Fail a Class	24.04	71.20	47.16	7.90	.0001
Catch a Cold	57.89	78.06	20.17	4.30	.0001

Note: Higher scores reflect a greater optimistic bias.

Table 8.

Relative Risk Estimates as a Function of Mood

Event	Positive Mood	Negative Mood	diff	t	p
Accident Injury	18.86	33.87	15.01	1.66	.11
Hangover	37.60	43.19	5.59	.40	.69
Fail a Class	37.79	55.09	17.30	1.48	.15
Catch a Cold	9.97	28.79	18.82	2.15	.05

Note: Higher scores reflect a greater optimistic bias.

Hypothesis 2 predicted that participants in the positive mood condition would make higher target risk estimates than would participants in the negative mood condition. I collapsed target risk estimate across all four events because I was making the same prediction for each event and then conducted a t-test to examine differences in target risk estimate due to mood. Contrary to predictions, analysis revealed that participants in the positive mood condition (M = 68.52) made lower target risk estimates than participants in the positive mood condition (M = 84.55), t (22) = -2.54, p < .02. To further examine these differences in target risk estimate, I conducted four independent sample t-tests based on target risk estimates for each event. Analysis yielded three significant differences in target risk estimate due to mood. Table 9 provides means, difference measures, t-statistics, and p-values for each of the significant findings. Contrary to predictions, for three of the four target events, participants' target risk estimates were significantly lower in the positive mood condition than in the negative mood condition.

Hypothesis 3 predicted that participants in the negative mood condition would make higher personal risk estimates than would participants in the positive mood condition. I collapsed personal risk estimates across events to examine differences in overall personal risk estimate due to mood. Analysis revealed no difference in overall personal risk estimate between participants in the positive mood condition (M = 42.46) and participants in the negative mood condition (M = 44.32), t (22) = -.29, p > .77. To probe for differences in personal risk estimates by event I conducted four independent sample t-tests. Table 10 presents means for each estimate. Although the means are in the predicted direction for two of the four cases, analyses yielded no significant differences

Table 9.

Target Risk Estimates of Participants in Positive and Negative Mood States

Event	Positive Mood	Negative Mood	Diff	t	p
Accident Injury	66.31	75.98	9.67	1.16	.26
Having A Hangover	80.20	94.60	14.40	3.36	.003
Failing A Class	58.28	82.14	23.86	2.81	.01
Catching A Cold	69.29	85.49	16.20	2.20	.04

Table 10.

Personal Risk Estimates of Participants in Positive and Negative Mood States

Event	Positive Mood	Negative Mood	Diff	t	p
Accident Injury	47.45	42.12	-5.33	-.59	.56
Having A Hangover	42.60	51.41	8.81	.60	.56
Failing A Class	20.49	27.05	6.56	.75	.46
Catching A Cold	59.32	56.69	-2.63	-.23	.82

Note: Means reflect personal risk estimates made by participants in positive and negative moods.

in personal risk estimates due to mood, all t's < .75 and all p's > .46. Thus, Hypothesis 3 was not supported.

I again examined the possibility that reported mood, rather than mood condition, would affect risk estimates by conducting three internal analyses. I used reported general mood score as a predictor of the three overall estimates: (1) overall optimistic bias (2) overall personal risk estimate (3) overall target risk estimate. Two of these tests yielded no effects. Specifically, reported general mood was not related to overall optimistic bias score, F (1, 22) = 1.83, p > .18 (B = -.28, p > .18) or overall personal risk estimate, F (1, 22) = 2.70, p > .11 (B = -.34, p > .11). However, general mood was negatively related to overall target risk estimate, F (1, 22) = 11.60, p > .003 (B = -.60, p < .01). The more positive the mood, the lower the target risk estimates made by participants. This finding is contrary to Hypothesis 2, but consistent with other findings reported earlier.

Thoughts as Risk Estimate Predictors

Hypothesis 4 predicted that event related thoughts would be related to risk estimates such that a greater number of thoughts regarding target event risk would be positively correlated with risk estimates, and a greater number of thoughts regarding target event avoidance would be negatively correlated with risk estimates. I conducted regression analyses to determine whether personal and target risk estimates were related to thoughts. Analysis revealed several findings of interest. Results are presented in Table 11.

Table 11.

Results of Regression Analyses Using Thought Items as Predictors of Risk Estimates

Event	Thought	Person Risk B	p	Target Risk B	p
Accident Injury	Personal Risk	**.90**	**.01**	-.05	.87
	Personal Avoid	**-.51**	**.08**	.38	.19
	Target Risk	-.09	.70	**.68**	**.02**
	Target Avoid	.16	.55	-.24	.38
Hangover	Personal Risk	.28	.49	-.41	.22
	Personal Avoid	**-.40**	**.01**	.49	.10
	Target Risk	-.05	.86	**.84**	**.01**
	Target Avoid	.19	.57	**-.50**	**.08**
Fail a Class	Personal Risk	-.48	.24	-.30	.39
	Personal Avoid	.44	.22	**.58**	**.07**
	Target Risk	.23	.44	**.72**	**.02**
	Target Avoid	-.36	.28	**-.53**	**.08**
Catch a Cold	Personal Risk	.20	.59	-.22	.55
	Personal Avoid	-.07	.83	.34	.29
	Target Risk	.24	.40	**.64**	**.03**
	Target Avoid	-.24	.45	-.29	.35

Note: Significant findings in bold.

Again, not all global analyses yielded the expected results. However, for exploratory purposes, I examined each relationship between thought and risk estimate. As evident, each event yielded at least one result that was in line with predictions. As evident, the extent to which participants reported thinking about things that they do that put them at risk for an event was positively related to their personal risk estimates. However, the extent to which participants reported thinking about things that they do to avoid the event was negatively related to personal risk estimates. Similarly, the extent to which participants reported thinking about things that others do that put them at risk was positively related to target risk estimates, and the extent to which participants reported thinking about things that others do to avoid the event was negatively related to target risk estimates.

Thought Listing

Two raters coded the number of thoughts generated by each participant, the focus of each thought (neither self nor other, self, other, or both self and other) and the affect associated with each thought (positive, negative, or neutral). Both raters coded 10 participants to establish agreement ratings. Agreement over the number of thoughts was 100%. Agreement on the focus of each thought was 98% and agreement for affect associated with each thought was 100%. In general, participants took the task to heart and provided thoughtful responses. For example, when asked what they were thinking about when making their risk estimate for catching a cold participants responded with such statements as:

"How much sleep I get".

"How much I have been sick in the past"

"How well I eat".

"What time of year it is (Cold/Flu season)".

Clearly, participants were providing thoughtful responses. In addition, many participants provided several thoughts for each risk estimate for each event. However, there was a mimicking effect. That is, many participants said they were thinking the same things about themselves and others when making risk estimates. For example, when thinking about risk of a car accident, one participant wrote:

"How fast I drive"

"How fast others drive"

"How reckless I am"

"How reckless others are"

"How many car accidents I have been in"

"How many car accidents people I know have been in"

Tabulation and comparison of thoughts for participants in each condition revealed no significant difference in the number of thoughts or the content of thoughts among participants in the positive, negative, and neutral mood conditions. The fact that there were no significant differences in thought listings could be due to the fact that participants often mentioned a few facts about each event and then mimicked thoughts regarding their own risk with thoughts of a target's risk.

Discussion

I predicted that mood would affect risk estimates such that participants in the positive mood condition would be more optimistically biased than would participants in the negative mood condition. This would be the result, I hypothesized, of participants in the negative mood condition making higher personal risk estimates than participants in the positive mood condition, and participants in the positive mood condition making higher target risk estimates than participants in the negative mood condition. The results revealed some evidence for the opposite. Participants in the negative mood condition were more optimistically biased than were participants in the positive mood condition in two of the eight cases. In addition, participants in the negative mood condition made higher target risk estimates than did participants in the positive mood condition in seven of the eight cases. These results are surprising given the findings of past research, though not necessarily surprising given the findings of Study 1.

The fact that participants were optimistically biased when in a negative mood does fall in line is consistent with a mood maintenance hypothesis. According to the mood maintenance hypothesis, people in a positive mood may continue performing activities that will lead to positive outcomes while people in a negative mood may engage in behaviors that will enhance their present mood. It may be that participants in a negative mood chose to view the target at more risk to make themselves feel better. However, this is only speculative. Although the evidence for the mood maintenance hypothesis is strong in other studies, this was not the focus of the current study and the results are limited.

The thought-listing task yielded no significant findings. That is, participants in the positive and negative mood conditions did not differ in the content of their specific thoughts. The lack of difference in thoughts between participants in the positive mood condition and the negative mood condition could be the reason that participants were no less optimistic in the negative mood condition. This result suggests that the mood manipulation was effective in changing participants' affect, but not their thought patterns. Perhaps it is necessary to change people's thought patters before any change in risk estimate is seen.

Of more interest for the present study was the finding that target event related thoughts were more consistently related to risk estimates for both personal and target risk estimates. Evidence from Study 1 combined with the current study suggests that event thoughts are related to risk estimates. It is particularly interesting that participant estimates of event related thoughts were consistently related to each of the risk estimates given that this measure was taken at the end of the risk estimation task.

There are problems with Studies 1 and 2, however. First and foremost, Studies 1 and 2 were conducted with no neutral mood control condition and therefore it is difficult to determine whether participants were indeed in a positive or negative mood state discrepant from a neutral mood state. It may be that participants responded to the positive mood manipulation but not the negative mood manipulation. In this case, all participants would at the very least be in a neutral mood. Without a neutral mood control condition, it is difficult to rule out this possibility. Indeed evidence using zero as a base mood score suggests that participants in the negative mood condition are in a slightly negative mood, but not significantly different from neutral mood.

Second, the type of event that was used in Studies 1 and 2 may have influenced displays of the optimistic bias. Although prior research suggests people are optimistically biased for the events used in Studies 1 and 2 (Weinstein, 1980, 1983; Abele & Hermer, 1993), few studies have used these events. Therefore, I decided to examine risk estimates for other events.

Third, neither Study 1 nor Study 2 counterbalanced the order of risk estimate. That is, participants in Studies 1 and 2 made personal risk estimates followed by target risk estimates. No participants first made target risk estimate followed by personal risk estimate. Although prior research suggests that counterbalancing has little influence on risk estimates, Study 3 used a counterbalancing procedure to determine if indeed there may be an effect.

STUDY 3

Overview and Hypotheses

The purpose of Study 3 was to reexamine the effect of mood on the risk estimates. There were several changes to the procedure for Study 3. First, a neutral mood condition was included in the mood induction process. Including a neutral mood condition allows a determination of whether positive and negative mood participants are experiencing states distinct from a neutral mood.

Second, the events were changed to determine whether mood might affect risk estimates made for other events. Specifically, having a motor vehicle crash and testing positive for a sexually transmitted disease replaced having an accident injury and having a hangover in the risk estimation packet. In addition, catching a cold was replaced with receiving a parking ticket, a fairly common event for students on the campus (Ortega, 1999).

Third, although prior research (Otten & van der Plight, 1996.) suggests that order of risk estimation does not affect displays of the optimistic bias, the following study counterbalanced the risk estimate procedure. That is, half of the participants made personal risk estimates first followed by target risk estimates, while the remaining participants made target risk estimates first followed by personal risk estimates.

Fourth, the method of question presentation used in Study 1 was again adopted for Study 3. That is, on each page of the questionnaire participants were presented first with four questions asking about risk for each event. Then, participants were asked a to rate how much time they spent thinking about their risk estimates. Finally, four questions assessed the extent to which participants were thinking about their personal and the target's risk and risk avoidance factors. After completing all 9 items for a particular event, participants went on to the next event until they had completed items for all four events. There were two reasons for this change. First, I believed that separating personal and target risk estimates as done in Study 2 would lead to a true measure of risk estimation. However, the switch in question presentation seemed to have little impact on risk estimation. Second, past research uses this conventional risk estimation procedure.

The hypotheses of Study 3 are similar to those of Studies 1 and 2:

Hypothesis 1: I predicted that participants in the positive mood condition would be more optimistically biased than would participants in the neutral mood condition who would be more optimistically biased than would participants in the negative mood condition.

Hypothesis 2: I predicted that participants in the positive mood condition would make higher target risk estimates than would participants in the neutral and negative mood conditions.

Hypothesis 3: I predicted that participants in the negative mood condition would make higher personal risk estimates than would participants in the neutral and positive mood conditions.

Hypothesis 4: I predicted that event related thoughts would predict risk estimates such that a greater number of thoughts regarding risk for the target events would be positively correlated with risk estimates, and that a greater number of thoughts regarding target event avoidance would be negatively correlated with risk estimates.

Method

Overview and Design

The design was a 2 (Target of estimate: Self vs. Other) X 3 (Mood: Positive vs. Neutral vs. Negative) mixed model with target of estimate serving as a within-subjects factor and mood serving as between-subjects factors.

Participants met an experimenter who explained that the study involved risk perception. The experimenter then induced a positive, neutral, or negative mood using the autobiographical recollection method. Following the mood manipulation all participants rated the likelihood that four different events would happen to them and the average student (their age and sex). In addition, participants rated the extent to which they were thinking about things that they and the average student do that put them at risk for the event and things that they and the average student do to avoid the event. After completing the risk estimation task, participants engaged in a thought-listing task. Following the thought listing participants were debriefed and given a gift (e.g. a small bag of candy) to place all participants in a positive mood.

Participants

Thirty-five introductory psychology students ($N = 35$) participated in sessions consisting of one to four participants. Their participation earned them partial credit for a course requirement. All conditions were randomly determined prior to participants' arrival.

Procedure

The procedure for Study 3 was the same as the procedure for Studies 1 and 2 with four exceptions. First, one-third of the participants underwent a neutral mood manipulation. The instructions during the autobiographical recollection task were the same for these participants as for those in the positive and negative mood conditions except that they were told to think "about a routine activity (ex. driving to school, cleaning the house, brushing their teeth, telephoning a friend)". Second, the items for which participants made personal and target risk estimates were changed. Participants made risk estimates for the likelihood that they and the average student their age and sex would: (a) be in a motor vehicle crash within the next year, (b) test positive for a sexually transmitted disease in their lifetime, (c) fail a class while attending the University of Florida, and (d) receive a parking ticket within the next year. Third, the order of estimates was counterbalanced. Half of the participants first made personal risk estimates and then target risk estimates. The other half of the participants first made target risk estimates and then personal risk estimates. Fourth, the questionnaire design was changed back to the same design used in Study 1. Aside from these four changes, there were no other differences in procedure from Studies 1 and 2.

Results

Manipulation Checks

In this study I manipulated mood such that participants were in a positive, neutral, or negative mood after the autobiographical recollection task. The same six items used in Studies 1 and 2 to assess mood were again used to assess participants' mood state in this study. Two composite scores, one indicating positive mood and one indicating negative mood, were created by summing scores on the three positive (alpha = .92) and the three negative (alpha = .93) manipulation check items respectively. A measure of general mood was constructed by subtracting negative mood scores from positive mood scores.

A one-way ANOVA revealed significant differences in general mood among participants in the three conditions, $\underline{F}$ (2, 33) = 15.22, $\underline{p} < .0001$. Planned contrasts revealed that participants in the positive mood condition ($\underline{M}$ = 10.25) were in a better mood than participants in the neutral mood condition, ($\underline{M}$ = 6.40), $\underline{t}$ (20) = 1.94, $\underline{p} < .06$, and participants in the negative mood condition ($\underline{M}$ = -3.42), $\underline{t}$ (22) = 4.91, $\underline{p} < .0001$. In addition, participants in the neutral mood condition were in a better mood than participants in the negative mood condition, $\underline{t}$ (20) = 3.31, $\underline{p} < .004$.

In addition, I conducted t-tests to determine whether the mood of participants in the positive, negative and neutral mood conditions significantly differed from zero. Analysis revealed that general mood scores of participants in the positive mood condition were significantly greater that zero, $\underline{t}$ (11) = 7.54, $\underline{p} < .0001$. Importantly, mood scores of participants in the neutral mood condition were also greater than zero, $\underline{t}$ (9) = 4.47, $\underline{p} < .002$. However, mood scores of participants in the negative mood condition were not significantly different from zero, $\underline{t}$ (11) = -1.41, $\underline{p} > .15$. In sum, the mood manipulation succeeded in placing participants in discrepant moods. However, these moods were different from what might be anticipated using zero as a measure of neutral mood. Indeed, using zero as a measure of neutral mood, participants in the neutral mood condition were actually in a somewhat positive mood and participants in the negative mood condition were in a neutral mood.

Another analysis was conducted to examine differences in anxiety among participants in the three mood conditions. First the three anxiety items were summed to create an anxiety index (alpha = .62). Though no differences were expected, a one-way ANOVA revealed significant differences in anxiety among participants in the three groups $\underline{F}$ (2, 33) = 3.90, $\underline{p} < .04$. Post-hoc comparisons using the Bonferroni approach revealed that participants in the neutral mood condition ($\underline{M}$ = 9.40) were more anxious than participants in the positive mood condition ($\underline{M}$ = 5.58), $\underline{t}$ (22) = 3.82, $\underline{p} < .04$. Anxiety scores of participants in the negative mood condition ($\underline{M}$ = 8.08) did not significantly differ from anxiety score of participants in the positive or neutral mood condition. Although unexpected, this difference poses no problems for interpretation of other measures. Finally, analysis revealed that positive mood correlated negatively with negative mood ($\underline{r}$ = -.57; $\underline{n}$ = 34; $\underline{p} < .0001$). In addition, anxiety correlated with neither positive mood ($\underline{r}$ = -.01; $\underline{n}$ = 34, $\underline{p} > .98$) nor negative mood ($\underline{r}$ = .20; $\underline{n}$ = 34, $\underline{p} > .25$).

Risk Estimates

Likelihood and probability estimates for each event were correlated to determine whether these indices could be collapsed. The correlations for the four events were all greater than $\underline{r}$ = .80. As a result, I standardized the likelihood and probability risk estimates and combined them to from a single probability scale. All analyses reported below reflect standardized probability estimates.

I first examined whether participants were optimistically biased in their risk estimates in general. I created difference scores by subtracting personal risk estimates from target risk estimates, such that positive scores reflected an optimistic bias, negative scores reflected a pessimistic bias, and scores of zero indicated realism. In total, four difference scores were created. I conducted four t-tests to determine whether participants' self-risk estimates were significantly less than participants' target risk estimates. Each test yielded a significant effect indicating that participants were optimistically biased (See Table 12).

Hypothesis 1 predicted that participants in the negative mood condition would be less optimistically biased than would participants in the neutral mood condition who would be less optimistically biased than would participants in the positive mood condition. Because I made the same prediction for each event, I collapsed across the four difference scores to form a general difference score. I then conducted an ANOVA to determine whether participants in the positive mood were more optimistically biased than were participants in a neutral mood, and whether participants in the neutral mood condition were more optimistically biased than were participants in the negative mood condition, across events. Analysis revealed no difference in optimistic bias due to mood (Positive Mood $\underline{M} = 43.12$; Neutral Mood $\underline{M} = 45.98$; Negative Mood $\underline{M} = 39.94$), $\underline{F}$ (2, 33) = .26, $\underline{p} > .77$. I then probed for differences in individual event optimistic bias score based on mood. Means are presented in Table 13.

Table 12.

Relative Risk Estimates

Event	Personal	Target	diff	t	p
Motor Vehicle Accident	43.98	76.79	32.81	7.90	.0001
Contract A STD	17.88	74.07	56.19	14.51	.0001
Fail A Class	29.71	70.28	40.57	8.48	.0001
Get A Parking Ticket	33.78	75.57	41.79	7.15	.0001

Note: Higher scores reflect a greater optimistic bias.

Table 13.

Relative Risk Estimates as a Function of Mood

Event	Positive Mood	Neutral Mood	Negative Mood
Motor Vehicle Accident	37.02	30.13	30.81
Contract A STD	57.32	51.49	58.99
Fail A Class	46.53	51.42	25.56
Get A Parking Ticket	31.62	50.86	44.38

Note: Higher numbers indicate greater optimistic bias.

A series of one way ANOVAs revealed a marginally significant effect of mood on the risk estimates regarding one's probability of failing a class, $\underline{F}$ (2, 33) = 3.12, $\underline{p} < .06$. Planned comparisons revealed that participants in the neutral mood condition ($\underline{M}$ = 51.42) were more optimistically biased than participants in the negative mood condition ($\underline{M}$ = 25.56), $\underline{t}$ (20) = 2.25, $\underline{p} < .04$. No other effects based on personal likelihood or probability estimates approached significance.

Hypothesis 2 predicted that target risk estimates made by participants in the positive mood condition would be greater than target risk estimates made by participants in the neutral and negative mood conditions. I collapsed target risk estimates across events to create an overall target risk estimate. A one-way ANOVA revealed no differences in overall target risk estimate due to mood (Positive Mood $\underline{M}$ = 72.41; Neutral Mood $\underline{M}$ = 80.10; Negative Mood $\underline{M}$ = 71.02), $\underline{F}$ (2, 33) = .33, $\underline{p} > .71$. To test for differences in target risk estimate by event I conducted a series of one-way ANOVAs. Means are presented in Table 14. Analysis revealed no differences in target risk estimates due to mood.

Hypothesis 3 predicted that personal risk estimates made by participants in the negative mood condition would be higher than the personal risk estimates made by participants in the neutral and positive mood conditions. I collapsed personal risk estimate across events yielding an overall personal risk estimate. I then tested for differences in overall personal risk estimate using a one-way ANOVA. Analysis revealed no difference in overall personal risk estimate due to mood (Positive Mood $\underline{M}$ = 29.28; Neutral Mood $\underline{M}$ = 34.12; Negative Mood $\underline{M}$ = 31.08), $\underline{F}$ (2, 33) = .71, $\underline{p} > .50$.

Table 14.

Target Risk Estimates

Event	Positive Mood	Neutral Mood	Negative Mood
Motor Vehicle Accident	77.75	79.62	73.47
Catch An STD	69.07	80.10	74.06
Fail A Class	74.10	77.48	60.47
Receive A Parking Ticket	68.70	83.20	76.07

I then probed for differences in personal risk estimate by event. Means are presented in Table 15. A series of one way ANOVAs revealed marginal significant differences among participants' risk estimates that they would contract a sexually transmitted disease, $\underline{F}\ (2, 33) = 3.71$, $\underline{p} < .04$. Planned comparisons revealed that participants in the neutral mood condition ($\underline{M} = 28.61$) rated their likelihood of contracting an STD higher than did participants in the positive mood condition ($\underline{M} = 11.75$), $\underline{t}\ (20) = 2.53$, $\underline{p} < .02$. No other effects approached significance.

To determine whether reported mood, rather than mood condition, affected risk estimates I again conducted three internal analyses. I used reported general mood score as a predictor of three overall estimates (across measurements and across events): (1) overall optimistic bias (2) overall personal risk estimate (3) overall target risk estimate. Each of these yielded no effects. Specifically, reported general mood was not related to overall optimistic bias score, $\underline{F}\ (1, 33) = .32$, $\underline{p} > .57$ ($\underline{B} = .10$, $\underline{p} > .57$), overall personal risk estimate, $\underline{F}\ (1, 33) = .02$, $\underline{p} > .87$ ($\underline{B} = -.03$, $\underline{p} > .85$), or overall target risk estimate, $\underline{F}\ (1, 33) = .22$, $\underline{p} > .64$ ($\underline{B} = .08$, $\underline{p} > .64$). Therefore, internal analyses revealed that, in addition to mood condition having little effect on risk estimates, reported mood also had no effect on risk estimates.

Table 15.

Personal Risk Estimates

Event	Positive Mood	Neutral Mood	Negative Mood
Motor Vehicle Accident	40.73	49.48	42.66
Catch An STD	11.75	28.61	15.06
Fail A Class	27.57	26.06	34.91
Receive A Parking Ticket	37.08	32.34	31.69

Thoughts as Risk Estimate Predictors

Similar to the regression analyses conducted in Studies 1 and 2, personal and target risk estimates were used as a dependent measure while the four questions assessing event related thoughts following risk estimation were used as predictors. Analysis revealed that event related thoughts were largely unrelated to risk estimates in Study 3. Results are presented in Table 16. As evident, only three thoughts yielded significant relationships with risk estimates. Of these three significant relationships, only two are in the predicted direction. Therefore, it appears that it thoughts were not strongly related to risk estimates.

Thought Listing

Specific thoughts gathered on the thought-listing task were once again coded using the same procedure used in Study 2. In particular, two raters coded the number of thoughts generated by each participant, the focus of each thought (neither self nor other, self, other or both self and other) and the affect associated with each thought (positive, negative, or neutral). Again, participants provided several thoughts for each event, and often mimicked personal and target risk associated thoughts. Tabulation and comparison of thoughts for participants in each condition revealed no significant difference in the number of thoughts or the content of the thoughts.

Table 16.

Results of Regression Analyses Using Thought Items as Predictors of Risk Estimates

Event	Thought	Person Risk B	p	Target Risk B	p
Vehicle Accident	Personal Risk	.09	.74	-.03	.93
	Personal Avoid	.15	.53	.13	.59
	Target Risk	-.32	.22	.16	.55
	Target Avoid	.13	.59	-.14	.58
Catch an STD	Personal Risk	.16	.49	.37	.10
	Personal Avoid	-.09	.63	.09	.59
	Target Risk	-.11	.65	-.11	.60
	Target Avoid	-.25	.22	**-.48**	**.02**
Fail a Class	Personal Risk	.13	.55	-.39	.07
	Personal Avoid	-.11	.62	-.03	.90
	Target Risk	.22	.28	**.34**	**.08**
	Target Avoid	-.23	.31	.09	.68
Receive Parking Ticket	Personal Risk	.34	.20	.46	.11
	Personal Avoid	**.43**	**.04**	.07	.73
	Target Risk	.12	.48	.11	.68
	Target Avoid	-.33	.18	-.41	.13

Note: Significant findings in bold.

Discussion

I hypothesized that mood would influence personal and target risk estimates such that participants in the negative mood condition would be less optimistically biased than would participants in the positive mood condition. I hypothesized this effect would be the result of participants in the negative mood condition making higher personal risk estimates and participants in the positive mood condition making higher target risk estimates. Again, mood seemed to have little effect on personal and target risk estimates or the optimistic bias. The fact that mood had little effect is again puzzling given that past research finds that mood moderates the optimistic bias.

One interesting finding that came from this study was that target event related thoughts seemed to have a much less predictable effect on risk estimates. Specifically, the extent to which participants were thinking about things that they or others do that put them at risk was inconsistently related to risk estimates. Similarly, the extent to which participants were thinking about things that they and others do to avoid a particular event was inconsistently related to risk estimates. Given the mixed results, it is difficult to be sure that people's event related thoughts influence their relative risk estimates.

Finally, to avoid extraneous variance, it may be helpful to have participants estimate risk using either the likelihood or probability scale only. During the debriefings of Study 3 many participants voiced that making risk estimates based on a one to nine scale and then a zero to 100 scale was somewhat redundant. To avoid boredom and practice effects, the likelihood estimation could be dropped and participants could make only self and target probability risk estimates for the four target events.

GENERAL DISCUSSION

Three studies examined the effect of mood on personal and target risk estimates. Each study yielded strong effects of the manipulation on mood. Participants in each of the three studies indicated that they felt more positively or negatively depending on their mood induction condition. However, these studies suggest that mood has little effect on risk estimates. The fact that mood had little effect was surprising given that past research finds that mood moderates risk estimates. Specifically, several studies find that people in a negative mood are less optimistically biased than are people in a positive mood (Salovey & Birnbaum, 1989; Abele & Hermer, 1993). In addition, other research finds that people who are depressed tend to be less optimistic than are people who are not depressed.

I do not believe that the studies conducted by Salovey and Birnbaum (1989) and Abele & Hermer (1993) yielded spurious findings. Indeed there are several aspects of the current study that could have led to the null results. First, neither Salovey and Birnbaum nor Abele and Hermer used thought questions to probe what participants were thinking about while making risk estimates. This process could have undermined the mood manipulation. In addition, the mood manipulation, though appearing effective, could have been less dramatic. Indeed, examination of mood scores compared to zero revealed that participants in the positive mood were in a positive mood. However, participants in the neutral mood condition of Study 3 were also in a positive mood and participants from all three studies were in more neutral moods, as measured by comparison to a base of zero. This one result may, in fact, be the reason that the current study yielded results discrepant from past studies. In the current set of studies, participants ruminated about the event for 5 minutes while participants in the Abele and Hermer study ruminated for 15 minutes. Perhaps this reduction in time spent pondering the episode diminished the effectiveness of the mood manipulation.

In addition, it is possible that participants were responding to a demand characteristic within the mood manipulation procedure. That is, perhaps participants intuited that they were supposed to be in a better or worse mood depending on whether they had to recall a positive or negative event for the autobiographical recollection task. However, during debriefing no participant voiced suspicion that the recollection task served to manipulate mood. In addition, other researchers have used the same mood inductor and no one has reported suspicion among participants. These two facts lead me to believe that the effect of mood on risk estimates is not as strong as it may appear in the optimistic bias literature. However, more research, perhaps using an alternative mood manipulation, would test this speculation.

Several findings of interest emerged in the present investigation. Most notable is the finding that target event related thoughts were related to risk estimates. Though many of the global analyses did not yield significant findings, several thoughts were related to risk estimates. However, it is important to note that these relationships were inconsistent. Examination of the events for which thoughts were strongly related to risk estimate yielded no findings. Nevertheless, relatively little research examines how people generate risk estimates. The present study hypothesized that participants in a positive mood use a "better than average" heuristic. Such a heuristic could lead one to make a particular risk estimate for the self and then put the average person at more risk or to make a particular risk estimate for the other and then put the self at less risk. The present study, however, reveals that risk estimation may be a somewhat more informed process. Indeed it is possible that when making personal risk estimates, people think of things that they do to avoid the target event or things that they do that put them at risk for the event. To the extent that people think of things they do to avoid an event, they should make lower risk estimates. Conversely, when people think of things they do that put them at risk for an event, they should make higher risk estimates. Again, however, evidence for this finding in this study is correlational and the cause of increased or decreased risk estimates cannot be known. Further examination of the topic using experimentation would yield strong evidence for a causal connection.

It is likely that participants then begin to think about others and imagine a prototypical or stereotypical target. This prototype is associated with various positive and negative characteristics. To the extent that people see the prototype as engaging in behaviors that lead to higher risk, they make higher target risk estimates. To the extent that people see the prototype as engaging in behaviors to avoid a particular event, they see the target as less at risk. Importantly, people may be motivated to think of specific characteristics of the prototype. Specifically, people who are at high risk for a particular event may be motivated to think of behaviors that others do that put them at higher risk. This way, people can avoid being seen in a bad light.

The goal of the present research was to determine how and why mood moderates the optimistic bias. Given that mood had little effect on risk estimates, I could not address these question. However, it could be that mood elicits particular thoughts regarding personal and target risk or avoidance strategies. In this way mood might have an indirect effect on risk estimates and the optimistic bias.

There are a few areas of weakness within the present investigation that may be useful for consideration in future research. Specifically, the present studies used the same mood manipulation. Though participants reported that they were in a more positive mood after remembering a positive event and a more negative mood after remembering a negative event, it is possible that they were responding to a demand in the study. Future research may benefit from using a variety of mood manipulations to avoid a demand explanation.

In addition, other researchers may wish to examine events other than those used in the present study. In hindsight, it appears that many of the events could be considered under the control of the individual. Receiving a parking ticket, getting in a motor vehicle crash, contracting a sexually transmitted disease, failing a class, having an accident injury are all relatively controllable events. It may be that mood has little effect on risk estimates for these events. Therefore, it may be that more uncontrollable events would be more susceptible to the influences of mood.

Although the present research was unable to determine why mood moderates risk estimates, it opens doors to future research. Specifically, there is a need to conduct research that examines the thought processes that affect risk estimation. Although several studies examine moderators of the optimistic bias, relatively little research examines the internal process of cognition during risk estimation. The present research provides a step in the direction of examining such internal processes.

In particular, researchers could examine only personal risk estimates made by one group of people and only target risk estimates made by a second group of people, while examining event related thoughts for each group. Without the interference of event related thoughts for the other person, the researcher may get a true picture of what participants are thinking about when they make risk estimates for themselves and for others.

Other research might examine the specific type of event or activity that mood may influence. Mood may influence uncontrollable events more than controllable events because people are less certain that they can do things to avoid the event. People in a negative mood may be able to boost their mood by thinking, "I hardly ever park illegally and therefore I don't get tickets". However, people in a negative mood who have to estimate their chance of an IRS audit may be more likely to think "Bad things happen to me sometimes and I can't control that, so it will probably happen". In addition, it could be that positive events would be more responsive to mood-induced variances in risk estimates. The present research used only negative events. Although past research typically finds stronger effects with negative events, the use of positive events may lead to stronger mood effects. More consideration of target event factors and a systematic study of such factors may be fruitful.

CONCLUSION

Although the present research was unable to discern why people in a negative mood are less optimistic, it opens the door for other avenues of research into the optimistic bias. Given that the optimistic bias is such a pervasive phenomenon, it is the challenge of future investigators to determine why people see themselves at less risk than they see others.

APPENDIX A
CONSENT FORM

Principal Investigator: Kevin M. Taylor, Graduate Student, 231B Psychology, 392-0601 ex 518.

Project Supervisor: Dr. James Shepperd, 271 Psychology, 392-0601 ex 248.

In this study, you will be asked to remember various life events. Afterwards, you will be asked to recall and write about 10 specific details of the event in question. You will complete the entire project within the 15 minutes available for the study.

If you agree to participate in this study at the University of Florida, please be aware of the following:

1. Each session will take 15 minutes.

2. Participation is voluntary and you will receive 1/2 experimental credit for your participation.

3. There are no discomforts or risks associated with the study. Neither are there any direct benefits from participation.

4. You do not have to answer any questions that you do not wish to answer and you may withdraw from the study at any time without consequence.

5. The experimenter will answer any questions that you may have at any time during the session.

6. Your responses shall remain confidential to the extent provided by law, as an arbitrary number will appear on the first response page.

7. You may contact the University of Florida Institutional Review Board at 392-0433 if you have any questions or concerns about your rights as a participant of this study.

8. You may feel free to ask further questions of the principal investigator, Kevin Taylor, at any time following your participation. 392-0601 ext. 518

I have read the statements and procedures described above. I voluntarily agree to participate.

Signature of Participant

Signature of experimenter

APPENDIX B
PERSONAL REACTIONS INVENTORY

Read each of the following items. Circle the number that best indicates how you feel right now, at this moment.

	Not at all			Moderately so			Very much so
1. worried	1	2	3	4	5	6	7
2. glad	1	2	3	4	5	6	7
3. depressed	1	2	3	4	5	6	7
4. nervous	1	2	3	4	5	6	7
5. happy	1	2	3	4	5	6	7
6. anxious	1	2	3	4	5	6	7
7. sad	1	2	3	4	5	6	7
8. upset	1	2	3	4	5	6	7
9. joyful	1	2	3	4	5	6	7

APPENDIX C
CONSENT FORM

Principal Investigator: Kevin M. Taylor, Graduate Student, 231B Psychology, 392-0601 ex 518.

Project Supervisor: Dr. James Shepperd, 271 Psychology, 392-0601 ex 248.

In this study, you will be asked to complete questions regarding your perception of your risk and another's risk for various activities and events. You will complete the entire project within the 30 minutes available for the study.

If you agree to participate in this study at the University of Florida, please be aware of the following:

1. Each session will take approximately 15 minutes.

2. Participation is voluntary and you will receive 1/2 experimental credits for your participation.

3. There are no discomforts or risks associated with the study. Neither are there any direct benefits from participation.

4. You do not have to answer any questions that you do not wish to answer and you may withdraw from the study at any time without consequence.

5. The experimenter will answer any questions that you may have at any time during the session.

6. Your responses shall remain confidential to the extent provided by law, as an arbitrary number will appear on the first response page.

7. You may contact the University of Florida Institutional Review Board at 392-0433 if you have any questions or concerns about your rights as a participant of this study.

8. You may feel free to ask further questions of the principal investigator, Kevin Taylor, at any time following your participation. 392-0601 ext. 518

I have read the statements and procedures described above. I voluntarily agree to participate.

Signature of Participant	Signature of experimenter

APPENDIX D
RISK ESTIMATION

The following packet contains risk events. For each event you are asked to make judgments regarding risk for the event. Please respond as honestly as possible for each event. Your responses will be completely anonymous and any information provided will be held in strict confidentiality. Thank you for your participation.

1. Estimate the likelihood that you will have an accident injury within the next year.
1 2 3 4 5 6 7 8 9
not at all likely very likely

2. Estimate the likelihood that the average UF student you age and sex will have an accident injury within the next year.
1 2 3 4 5 6 7 8 9
not at all likely very likely

3. Estimate the probability that you will have an accident injury within the next year. Your estimate should fall between 0% and 100%. Please report an exact number not a range. ________

4. Estimate the probability that the average UF student your age and sex will have an accident injury within the next year. Your estimate should fall between 0% and 100%. Please report an exact number not a range. ________

5. How much time did you spend on the estimates that you just made?
1 2 3 4 5 6 7 8 9
not very much a lot

When you answered the previous questions:

6. To what extent were you thinking about things that you do to avoid accidents?
1 2 3 4 5 6 7 8 9
not at all very much

7. To what extent were you thinking about things that other people do to avoid accidents?
1 2 3 4 5 6 7 8 9
not at all very much

8. To what extent were you thinking about things that you do that put you at risk for accidents?
1 2 3 4 5 6 7 8 9
not at all very much

9. To what extent were you thinking about things that other people do that put them at risk for accidents?
1 2 3 4 5 6 7 8 9
not at all very much

10. Estimate the likelihood that you will have a hangover within the next three months.
1 2 3 4 5 6 7 8 9
not at all likely very likely

11. Estimate the likelihood that the average UF student you age and sex will have a hangover within the next three months.
1 2 3 4 5 6 7 8 9
not at all likely very likely

12. Estimate the probability that you will have a hangover within the next three months. Your estimate should fall between 0% and 100%. Please report an exact number not a range. ________

13. Estimate the probability that the average UF student your age and sex will have a hangover within the next three months. Your estimate should fall between 0% and 100%. Please report an exact number not a range. ________

14. How much time did you spend on the estimates that you just made?
1 2 3 4 5 6 7 8 9
not very much a lot

When you answered the previous questions:

15. To what extent were you thinking about things that you do to avoid having a hangover?
1 2 3 4 5 6 7 8 9
not at all very much

16. To what extent were you thinking about things that other people do to avoid having a hangover?
1 2 3 4 5 6 7 8 9
not at all very much

17. To what extent were you thinking about things that you do that put you at risk for having a hangover?
1 2 3 4 5 6 7 8 9
not at all very much

18. To what extent were you thinking about things that other people do that put them at risk for having a hangover?
1 2 3 4 5 6 7 8 9
not at all very much

19. Estimate the likelihood that you will fail a class while attending the University of Florida.

1 2 3 4 5 6 7 8 9
not at all likely very likely

20. Estimate the likelihood that the average UF student you age and sex will fail a class while attending the University of Florida.

1 2 3 4 5 6 7 8 9
not at all likely very likely

21. Estimate the probability that you will fail a class while attending the University of Florida. Your estimate should fall between 0% and 100%. Please report an exact number not a range. ________

22. Estimate the probability that the average UF student your age and sex will fail a class while attending the University of Florida. Your estimate should fall between 0% and 100%. Please report an exact number not a range. ________

23. How much time did you spend on the estimates that you just made?

1 2 3 4 5 6 7 8 9
not very much a lot

When you answered the previous questions:

24. To what extent were you thinking about things that you do to avoid failing a class?

1 2 3 4 5 6 7 8 9
not at all very much

25. To what extent were you thinking about things that other people do to avoid failing a class?

1 2 3 4 5 6 7 8 9
not at all very much

26. To what extent were you thinking about things that you do that put you at risk for failing a class?

1 2 3 4 5 6 7 8 9
not at all very much

27. To what extent were you thinking about things that other people do that put them at risk for failing a class?

28. Estimate the likelihood that you will catch a cold within the next three months.

1 2 3 4 5 6 7 8 9

not at all likely very likely

29. Estimate the likelihood that the average UF student you age and sex will catch a cold within the next three months.

1 2 3 4 5 6 7 8 9

not at all likely very likely

30. Estimate the probability that you will catch a cold within the next three months. Your estimate should fall between 0% and 100%. Please report an exact number not a range. ________

31. Estimate the probability that the average UF student your age and sex catch a cold within the next three months. Your estimate should fall between 0% and 100%. Please report an exact number not a range. ________

32. How much time did you spend on the estimates that you just made?

1 2 3 4 5 6 7 8 9

not very much a lot

When you answered the previous questions:

33. To what extent were you thinking about things that you do to avoid catching a cold?

1 2 3 4 5 6 7 8 9

not at all very much

34. To what extent were you thinking about things that other people do to avoid catching a cold?

1 2 3 4 5 6 7 8 9

not at all very much

35. To what extent were you thinking about things that you do that put you at risk for catching a cold?

1 2 3 4 5 6 7 8 9

not at all very much

36. To what extent were you thinking about things that other people do that put them at risk for catching a cold.

1 2 3 4 5 6 7 8 9

not at all very much

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BIOGRAPHICAL SKETCH

Kevin Michael Taylor was born on February 15, 1972, in Kalamazoo, Michigan. Kevin attended the University of Michigan, where his interest in social psychology was sparked by an introduction to social psychology class and research he conducted with several prominent social psychologists including Richard Nisbett, Norbert Schwarz, and Robert Zajonc. He completed his Bachelor of Arts degree in psychology in May 1994. In fall 1994, Kevin began his graduate studies in social psychology at the University of Florida. He started his apprenticeship under the guidance of Dr. James Shepperd and began a productive research career. Throughout his graduate career Kevin was interested in the self and self-protective processes which eventually led to his study of the optimistic bias. Kevin completed his Master of Science degree in social psychology in May 1997, a study that examined how the severity and timing of feedback affected the optimistic bias. After a brief time away from the department to complete an internship in Austin, Texas, Kevin returned to the University of Florida to complete his doctorate, an examination of the interplay of mood, cognition, and the optimistic bias. In March 2000, Kevin began a career as an applied social psychologist in San Jose, California.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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